

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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J. B. LIPPINCOTT COMPANY, PUBLISHERS

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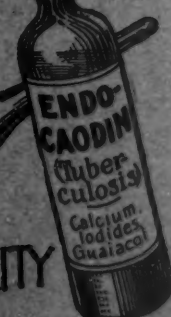
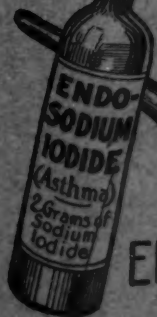
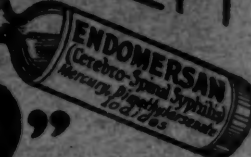
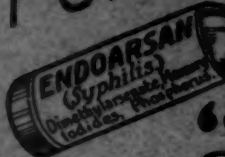
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ANNALS *of* SURGERY

VOL. LXXIII

MAY, 1921

No. 5

THE RESULTS OF SURGICAL TREATMENT OF EPITHELIOMA OF THE LIP *

BY WALTER ELLIS SISTRUNK, M.D.

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SECTION ON SURGERY, MAYO CLINIC

JUDD and BECKMAN have reported the results obtained in the Mayo Clinic by operations for cancer of the lower lip. The present study was made with the idea of determining the results of a number of years following such operations. I have, therefore, recently reviewed in detail the case histories of the patients operated on during 1912, 1913, and 1914; that is, from five to eight years ago. The results in this group of cases differ somewhat from those previously reported by Judd and Beckman.

In cancer of the lip, as in cancer in other regions of the body, a great difference in results is to be expected in the cases in which the glands are involved at the time of operation compared with those in which operation is performed early, before glandular involvement can be demonstrated. In the group selected for study the best results were obtained in the patients operated on before glandular involvement could be demonstrated and in whom the glands which drain the lip were removed as a prophylactic measure.

Epithelioma of the lip, on account of the ease with which the diagnosis may be made and the ease with which the growth and the glands draining it may be removed, may be classed as one of the most favorable types of malignancy. In spite of these advantages and possibilities, however, one finds, on reviewing the results obtained by operation, that many patients die each year of this disease. These deaths occur primarily because of delay on the part of the patient in seeking surgical aid or delay on the part of the physician consulted in recommending a radical operation.

Any ulcer of the lip which persists for a few weeks should be regarded as highly suspicious of cancer. If such ulcers are surrounded by a slightly indurated area, the great majority prove to be epitheliomas. They occur most often in males above thirty-five years of age, but the condition is frequently seen in younger persons, so the age cannot be regarded as an important factor. Practically the only other condition to be taken into consideration in the diagnosis is syphilis, a condition in which lesions on

* Read before the Oswego County Medical Society, Oswego, New York, October, 1920.

the lip are seldom seen. In cases in which doubt exists as to the true nature of the condition, it is best to excise the growth by a V incision for diagnostic purposes. Very little deformity results from such a procedure and, if the condition is found to be malignant, good results may be expected to follow a radical removal of the glands at this time or shortly afterward.

The lymphatic drainage from the lower lip passes through the submental and submaxillary groups of lymphatics. The submental lymphatics lie in the triangle bounded by the anterior bellies of the digastric muscle and of the hyoid bone and drain the central portion of the lower lip. The submaxillary lymphatics lie in the submaxillary triangles, each of which is bounded by the digastric muscle and the ramus of the lower jaw; these lymphatics drain the remainder of the lower lip as well as the anterior portion of the cheek. Under ordinary conditions the outer portion of the lower lip on each side is drained by the submaxillary lymphatics on that side. The lymphatic anastomosis in this region is free and in case of any blocking of the lymphatics on either side by inflammation or cancer, the lymph may drain through the lymphatics on the opposite side. For these reasons it is necessary in treating cancer of the lip to remove the submaxillary lymphatics on each side. We have frequently seen involved glands on the side of the neck opposite the growth while no glandular involvement could be demonstrated on the side with the growth.

In small growths, when the diseased tissue can be removed by the ordinary V incision, it is best to excise the glands first and immediately after the incision has been closed and while the patient is still under an anæsthetic, to remove the growth from the lip. If, however, the growth is extensive and it is necessary to remove a large portion of the lip, it is usually better to perform the operation in two stages. In such cases, if the glands are excised first the growth may be removed after three or four days under a local anæsthetic or, if preferred, the growth may be removed first. The only objection to the latter method is that occasionally considerable infection follows the removal of the growth and this makes it necessary to delay removing the glands.

If possible the glands which are removed should be examined immediately. If laboratory facilities do not permit this the tissues removed from each side should be kept separate and carefully labelled in order to show definitely later which side is involved in case the tissues removed are found to be malignant.

The technic employed in removing the submaxillary and submental glands as a prophylactic measure in the ordinary patient with cancer of the lip is as follows:

An incision is made parallel with the body of the lower jaw about midway between the upper portion of the thyroid cartilage and the symphysis of the jaw, and extending from the inner border of the sternomastoid on one side to a similar point on the opposite side. The skin

EPITHELIOMA OF THE LIP

and platysma muscle are reflected upwards as high as the jaw-bone and all of the glands and fascia lying between the anterior bellies of the digastric muscles (the submental group) are excised. The glands, fascia, and fat, including the submaxillary salivary gland, are then removed from each submaxillary triangle. The lower jaw limits the dissection above and the pulley and posterior belly of the digastric muscle are used as landmarks to limit the dissection below. Both submaxillary salivary glands are removed because they are surrounded by small lymphatics. The ducts of the submaxillary salivary glands are cut off just underneath the mylohyoid muscle, and the facial arteries and veins are cut off at the level of the digastric muscle and again at the point where they cross the lower jaw-bone.

It is necessary to guard against injury, first, to the lingual branch of the fifth nerve which runs underneath the mylohyoid muscle at a point just above the salivary duct; second, to the hypoglossal nerve which passes underneath the digastric muscle near its pulley and then runs underneath the mylohyoid muscle just below the salivary duct, and third, to the inframandibular branch of the seventh nerve which crosses over the facial vessels at a point about 1.5 cm. below the jaw-bone. All of these nerves are important and should be avoided. The lingual branch of the fifth nerve on each side supplies sensation to one-half of the tongue; each hypoglossal nerve supplies motion to one-half of the tongue, and the inframandibular branch of the seventh nerve on each side supplies motion to its one-half of the lower lip and angle of the mouth. The hypoglossus muscle forms the bottom of the submaxillary triangle; all the fat down to this muscle is removed.

If the glands on either side are found to be involved at the time of operation all the glands draining that side of the neck should be removed by what is ordinarily known as block dissection. In such cases the primary incision is extended outward on the side where the involvement is found across the sternomastoid muscle, and a second incision is made at right angles to the first, beginning at the inner border of the sternomastoid above, and extending downward to a point near the juncture of the inner and middle thirds of the clavicle. The glands and fascia from all the triangles on that side of the neck are then removed up to a point as high as the styloid process; the dissection extends down to the deep muscles of the neck, the glands and fascia lying along the carotid artery and the internal jugular vein being removed. Care must be taken to avoid the phrenic nerve, the brachial plexus, the common and internal carotid arteries and the hypoglossal, pneumogastric and sympathetic nerves. The sensory branches of the cervical nerves are cut near the point where they emerge from the muscles. The omohyoid and sternomastoid muscles are removed and the spinal accessory nerve is sacrificed. Of course, the sacrifice of this nerve is followed, in the majority of cases, by paralysis of the trapezius muscle. It is possible to preserve the

sternomastoid muscle and the spinal accessory nerve, but this requires more time and the operation probably is not so thorough, so, because of the seriousness of the condition which is being dealt with, it seems permissible to sacrifice these structures. If the internal jugular vein is involved it may be sacrificed on one side of the neck without fear of a bad result. Injury to the common carotid or the internal carotid arteries, necessitating the ligation of either of these vessels, especially in patients more than forty, will be followed by an extremely high mortality. If necessary, the external carotid may be ligated on one or both sides. An operation of this type, although long, is associated with a very low operative mortality.

In reviewing the histories of the patients operated on in the Mayo Clinic during the years 1912, 1913, and 1914, only the patients who had primary operations in the Clinic were considered, in order that we might more clearly ascertain the possibilities of the operation in primary cases. In many of these patients, however, the growth had been removed or partially destroyed on one or more occasions by the use of pastes or caustics. After dropping from the series the cases of recurrence, 178 remained. In two of these an incomplete operation was performed; that is, an operation in which it was impossible to remove all the diseased tissue; these two cases were, therefore, discarded from the list studied. We were unable to obtain data after operation in thirty-four cases; these were also dropped from the list, leaving 136 cases which form the basis of the study.

In attempting to obtain a true report of the results obtained following operations performed a number of years before, it is often difficult to know just what cases should be discarded from the list to be studied. Nothing can be learned of the end-results secured from a study of the histories of patients concerning whom no data can be obtained after operation. Previous studies of histories in a large series of patients operated on years before have proved conclusively that the majority of patients from whom no data can be secured are alive. The longer one attempts to obtain information regarding such patients the higher, as a rule, is the percentage of cures obtained. It is usually easy to hear that patients are dead; those who are living a considerable period after operation have often changed addresses several times and letters to them are returned unclaimed.

The 136 cases were studied in three groups:

Group I comprises ninety-eight cases in which a primary complete operation was performed when the glands were not involved; that is, a local excision of the growth with removal of the glands draining the lower lip. Fourteen of these patients are dead; five had died from disease other than the cancer and without a recurrence of the malignancy. Three letters were returned marked "deceased" without further data regarding the cause of death or as to whether a recurrence had occurred.

EPITHELIOMA OF THE LIP

Six patients had apparently died of a recurrence of the disease. If the five patients who died of other causes are excluded, ninety-three patients remain on whom primary complete operations were performed, with nine deaths, six of these deaths from known recurrences; consequently, 90.3 per cent. of the patients are alive from five to eight years after operation. In eleven of these local recurrences occurred and in three recurrences occurred in the glands, which were subsequently removed; two of these probably have a recurrence at the present time.

Group 2 comprises eleven cases in which the glands were involved at the time of operation. In six cases a block dissection was done in addition to removal of the submaxillary and submental lymphatics. Five of these patients are dead and one is alive, five years and three months after operation. In the five other cases of this group, on account of the age or physical state of the patient block dissections were not done; the involved groups of glands only were removed. Four of these patients are dead and one is alive five years and eight months after operation. Of the eleven patients, then, who had glandular involvement, only two (18.1 per cent.) are alive five to eight years after operation. In this group it is known that one local recurrence and three recurrences in the neck occurred. This percentage of cures is much lower than that previously reported from the Clinic, but the duration of time since the operation is considerably longer in the group of patients studied in this paper than that in the groups on which the former statistics are based.

Group 3 comprises twenty-seven cases in which the growth only was excised, usually on account of the age or physical condition of the patient. Nineteen of the patients are alive from five to eight years following operation. Three of those who died are supposed to have died of disease other than cancer of the lip and without a recurrence of the malignancy. If these patients are deducted from the group, twenty-four remain, with five deaths; that is, 79.2 per cent. of from five- to eight-year cures. Seven of the patients who are alive had recurrences of the growth which were subsequently removed; one of these probably has a recurrence at the present time. Two of the patients who died had local recurrences and three had recurrences in the submaxillary glands.

A review of these cases shows that the percentage of cures following operation in cases in which the glands are involved are much lower than in cases in which operation was performed before the glands became involved. The percentage of from five- to eight-year cures when the glands were involved is almost identical with that obtained in cases of cancer of the breast when the glands are involved. The percentage of local recurrences seems too large. This probably could be avoided to a certain extent by a wider removal of the growth and the use of radium after operation. Rapidly growing epitheliomas, and especially those growths with a marked inflammatory reaction surrounding them, are best removed with the actual cautery without attempting to perform a plastic opera-

tion at the time. In cases in which the glands have liquefied, broken down and extensively involved the surrounding tissues no relief can be expected. Such cases are probably best treated by means of radium and X-ray.

Treatment of the growth by means of radium and the X-ray without removal of the glands does not seem a radical procedure. We have seen a number of patients with an extension of the malignancy later into the glands while the primary lesion remained cured. There is no doubt that radium often destroys the growth, but such a procedure is almost identical with the methods in which the growth is removed with pastes or by local excisions. We know from experience that although there may be no local recurrence of the growth following the latter procedures, in about from 20 per cent. to 30 per cent. of the cases, metastasis occurs later in the submaxillary and submental glands.

SALIVARY CALCULUS IN AN ACROMEGALIC

BY CHESTER JONES, M.D.

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(From the Surgical Service of the Peter Bent Brigham Hospital)

THE following example of a rather infrequent pathological condition offered an interesting problem for differential diagnosis.

SURG. NO. 11558.—Mrs. C. G., aged fifty-six years, was admitted November 26, 1919, complaining of a tumor under the right jaw.

The patient, an acromegalic of marked degree, had first noticed two or three years before entrance a hard, painless swelling beneath the angle of the right jaw, the size of a small grape. This caused no symptoms and showed no apparent increase in size until two months ago. At that time, without known cause, this swelling increased suddenly in size, becoming very tender and painful. In about twelve hours it became the size of a small egg, the cheek, floor of the mouth and right side of the tongue all being swollen. There was marked dysphagia and speech was practically impossible on account of the intense pain accompanying any movement of the jaw or throat. The patient was unable to sleep at night. In addition to the severe local pain there were spasmodic attacks of darting pain in the supra-orbital, auricular and maxillary regions.

This condition persisted for about two weeks without relief, and without the patient being able to tolerate anything by mouth except occasional sips of fluid. Hot poultices were applied externally to the tumor with slight relief. Gradually the swelling subsided to about the size of a walnut and the acute symptoms disappeared except for occasional twinges of pain along the mandibular division of the trigeminal nerve. A diagnosis of osteoma of the jaw had been made two weeks before admission, based upon an X-ray examination.

Examination.—The patient showed the physical characteristics of chronic acromegaly, but with no pressure symptoms from the glandular enlargement. The swelling below the angle of the jaw was, therefore, the only consideration so far as treatment or diagnosis was concerned. This was a hard mass about the size of a walnut just below the angle of the right lower jaw, to which it was apparently attached, and though there was possibly some slight mobility, the mass suggested a skeletal exostosis associated with her acromegaly.

A second X-ray examination, however, revealed an opaque, probably calcified body, not connected with the jaw, the shadow measuring 24 mm. by 32 mm. (Fig. 1).

Operation.—Under a local anæsthetic, by an external incision, the entire lesion was found to be limited to the submaxillary gland,

which was removed. The surrounding tissues were indurated and somewhat thickened. The patient recovered without any complications.

Pathological examination showed an indurated submaxillary gland, containing an irregular, yellow mass of calcareous substance, filling a cavity in the gland lined with a definite membrane. The cavity communicated directly with Wharton's duct, and the calculus could be readily felt by a probe passed down the lumen of the duct. It was roughly olivary in shape, one end tapering to a point as it entered the duct (Fig. 2). Its weight was 9.4 gm. By microscopical examination the surrounding tissues showed a chronic inflammatory process, with increase in fibrous tissue. The above calculus was much larger than the majority of those reported in the literature.

A correct diagnosis should be made prior to operation by combining the physical findings, the history of sudden swelling and pain, dysphagia, and the shadow shown by the X-ray. Failure to make such a diagnosis may be attributed to the fact that a salivary calculus was not considered, and further that a careful bidigital examination was not made of the mass, nor was Wharton's duct explored with a probe.

Examination of the literature shows that salivary calculi, while uncommon, occur with sufficient frequency to render their diagnosis important and not extremely difficult. An analysis of numerous articles reveals a characteristic set of symptoms. Sudden onset of pain in the floor of the mouth, over the submaxillary region, or that of the other salivary glands, associated with swelling and exquisite tenderness, all increased by food and mastication, are the primary symptoms. A mass may or may not have been noticed prior to the attack. In the above case the mass was known to have existed in the submaxillary region for about three years without symptoms. Several cases have been reported where there was a known hard tumor in the submaxillary region present for over ten years. In one of Alexander's cases such a tumor had been present between thirteen and fourteen years. On the other hand, the calculus may have existed for years without being discovered, the only knowledge of abnormality presenting itself with the initial attack of acute symptoms, entirely analogous to the so-called "silent" renal or biliary stones.

Examination generally shows a distinct swelling in the region of one of the salivary glands, best demonstrated by bidigital examination, the swelling being hard, slightly movable, and very tender in acute cases. If the stone be in the submaxillary gland it is frequently possible to palpate it by means of a probe passed into the lumen of the duct, and not infrequently pus may be extruded from the duct orifice by gentle pressure on the gland. X-ray will confirm the findings by showing a distinct shadow in the region of the tumor. In severe cases the floor of the mouth is very swollen and tender, as may be the cheek and tongue on the same



FIG. 1.—Calculus in submaxillary gland.



FIG. 2.—Calculus embedded in submaxillary gland.

SALIVARY CALCULUS IN AN ACROMEGALIC

side. Talking and swallowing are extremely painful, and may be impossible—indeed, the swelling may be so great as to prevent examination by mouth. Abscess of the affected gland may be present, with necrosis and even fistula formation. Usually the patient will give a history of intermittent attacks of painful swelling in the regions of the affected gland, of sudden onset, increased by food, and generally of short duration and rather sudden regression.

Cases have frequently been diagnosed as carious teeth with root abscesses to be contradicted by X-ray. Many have been diagnosed carcinoma or osteoma, the calculus being discovered only at operation.

Salivary calculi are formed from the inorganic salts in solution in the normal saliva. Under abnormal conditions these are deposited, usually on the teeth as tartar, occasionally in the salivary ducts or acini as calculi. The calculi may have as nuclei bacteria, epithelial debris or a foreign body. The inorganic salts concerned are the carbonates and phosphates of lime, potash and magnesium. Bacterial action or actual lodgment of a foreign body sets up an inflammatory process around the orifice of a duct or acinus, which causes blocking, constricting or roughening, and the decomposition of the saliva, with consequent deposition of salts. Calculus formation gradually results, the final stage being a stone which may later be rejected if not of large size. On the other hand, it may be retained in the gland or duct, obstructing the flow of saliva and causing the symptoms which had been mentioned. Occasionally, however, there occurs no obstruction or symptoms therefrom.

Salivary calculi are most often found in Wharton's duct, but may be found in the gland itself or in either of the other salivary glands or their ducts. In the Breslau clinic, Czygen reports thirty-seven cases, occurring as follows: Wharton's duct, 22; submaxillary gland, 4; Stenson's duct, 5; parotid gland, 1; sublingual duct, 4; Bartholini's duct, 1; total, 37. Bevan's report of twenty cases seen at the Presbyterian Hospital, Chicago, gives a similar occurrence. Keen states that the calculi occur in the submaxillary gland and ducts five times more often than elsewhere. Other observers do not give so high a percentage as this, but all agree that the stones more often occur in or near Wharton's duct.

The majority of cases occur in males around middle life, few being found in children, although one case is reported of a salivary calculus in an infant of three weeks.

Calculi vary in size from that of a BB shot to that of a large walnut. Those smaller than a bean are usually ejected spontaneously without symptoms. They are usually yellow in color, irregular in shape, and if large and located in a gland, taper at one end to conform to the entrance into the gland of its duct. They are usually single, but multiple calculi have been reported.

Complications if untreated may be serious. Abscess formation is the most common. Fistula may result, and necrosis of the jaw following a

large abscess may occur. Ranula has been reported following obstruction of a duct, although the usual obstruction is not a permanent thing.

Treatment is always surgical, removal of the calculus and, if necessary, of the affected gland. In the case of small stones an incision in the buccal mucosa over the aperture of the duct will frequently be sufficient. Where the gland is involved, and there is inflammation and induration, radical removal is best, and an external incision and dissection is necessary. In the cases where the parotid is involved this may be extremely difficult, owing to its close relation to numerous important anatomical structures which may be involved in the process. Healing of the wound following operation generally occurs without the formation of fistula or other complications. Recurrences of stones have been reported, but are rare.

Salivary calculi, though not common, occur with sufficient frequency to warrant careful consideration. They should always be included in a differential diagnosis of tumor involving the floor of the mouth, lower jaw, or the parotid. Clinical symptoms and findings are ordinarily sufficiently characteristic to determine the diagnosis. If not, röntgenogram examination will decide the nature of the tumor and its exact location, and occasionally will pick up cases that were previously unsuspected. Selby's report of nine cases of salivary calculi that were discovered after being referred as root abscesses is enlightening. In all but one of his cases calculus was not even considered, but the diagnosis was made by careful stereoplates, which he believes essential to accurate demonstration. Complications of sialolithiasis may be very serious, and surgical treatment is always indicated where any abnormal symptoms exist.

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THE TREATMENT OF ACUTE SUPPURATIVE PLEURISY

BY JAMES MORLEY HITZROT, M.D.

AND

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WITHIN recent years a great impetus has been given to the study of suppurative pleurisy by the epidemic of pulmonary diseases, especially influenza, which swept over the world and by the larger number of chest wounds with their coincident infection which occurred during the World War.

The resulting studies of the condition have given evidence that there was and still is much to be learned regarding this condition, and that there is a definite need for a better understanding of the methods of treatment applicable to the various types of the disease.

Given a case of suppurative pleurisy established by the orthodox methods of diagnosis (physical signs, aspiration of chest, X-ray examination), what must our treatment be? First, to save the life of the patient. Second, to leave the patient with a symmetrical chest and fully expanded lungs, and third, to shorten the time of the patient's convalescence.

The types of suppurative pleurisy ordinarily given are diffuse, encapsulated, sacculated, intralobar, etc. While the above are terms of relative value, it would seem that the type of the infecting organism plus the nature or source of the original disease would be of more value and lead to a better understanding of the factors concerned in the treatment of the disease. For that reason it would be better to classify the various types of suppurative pleurisy, for example, as:

Suppurative pleurisy—pneumococcus—second to pneumonia.

Suppurative pleurisy—streptococcus—second to influenza, etc.

The reason for so doing can be definitely explained by the difference easily noted in the two above forms.

The suppurative pleurisy due to the pneumococcus is usually secondary to a lobar pneumonia, the patient is usually past the extremely critical stage of the disease and the exudate is definitely purulent when recognized; that is, the condition is a sequel or complication of the original disease. Treatment in this variety can be directed toward the removal of the purulent exudate and is chiefly concerned with the restoration of chest function in the shortest time possible.

In the suppurative pleurisy, due to the streptococcus, the exudate usually occurs very early in the disease and is, as a rule, not purulent at first. The patient is in the most critical stage of the disease with marked cyanosis, dyspnoea and prostration as a result of the severe infection and

not as a result of the pleuritis. That is, in this variety the pleurisy is a part of the disease, occurs early and does not become frankly purulent until an interval of at least two or three weeks has elapsed. (See report of the Empyema Commission, *Journal American Medical Association*, vol. lxxi, 1918.)

Failure to recognize the above differences in type cannot do otherwise than produce undesirable results, and early operations done as soon as the diagnosis of suppurative pleurisy was recognized in the streptococcus cases produced a very high mortality.

It had also seemed to the writers that the older classifications of the suppurative pleurisies could not be considered of value from the standpoint of the treatment of the varying types. That is, it was the writers' impression that the variety of suppurative pleurisy which followed lobar pneumonia, and in which the pneumococcus was the cause of the suppurative pleurisy, seemingly recovered rapidly and satisfactorily when sufficient drainage was inducted and maintained, and that the mortality was more or less dependent upon an early recognition of the presence of pus in the pleura and its prompt removal.

Contrariwise, there was another variety of suppurative pleurisies due to a varying group of organisms in which it was not so simple a matter to outline a method of surgical treatment which gave the satisfactory outcome experienced in the first group, and that more extensive operations and more frequent secondary operations were required to effect a cure.

As has been stated, the streptococcus pleurisies in influenza did not and could not do well by early operations done during the critical period of the disease. Furthermore, the pleural infection was the result of small or larger lung abscesses which ruptured into the pleural cavity and produced a more complicated pathological process than that in the first group. (See Hartwell.¹)

Hence the methods applicable to the first group must be modified to suit the individual requirements of the various varieties of this second group as they occurred.

These factors have been fully substantiated by the experience of the Empyema Commission during the war, and by the recent contributions of Lilienthal, Eggers, Moschowitz, Hartwell, Hedbloom, Homans, Tuffier and others. Many of these factors will be discussed later when the analyses of the cases upon which this report is based are examined.

Since the advent of the X-ray and its more careful and complete application to and the more skilful interpretation of the plates of the various types of suppurative pleurisy there has been a decided improvement in the results obtained.

The result of aspiration of the chest cavity can thus be followed and residual exudates removed by operation, or when operation has been done the progress of the case, *i.e.*, the expansion of the lung and the closure of

¹ Abscess of Lung: *ANNALS OF SURGERY*, 1920, vol. lxxii, p. 333.

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the purulent cavity or the factors which are causing delay, can be more definitely determined.

Furthermore, it has also seemed to the writers that the more extensive exploration of the chest cavity, such as that popularized by Delorme, Fowler, and Lilienthal, has rapidly tended to replace the older chest-deforming operations of Estlander and Schede, a marked advance in the writers' opinion.

Experience with these operations and the more formidable operations of lobectomy for the pulmonary lesions which complicate the disease will rapidly approach the satisfactory surgical position now occupied by other major surgical procedures which not long since were considered entirely too radical.

The experience of any one individual is unlikely to cover all the manifold manifestations of this condition, hence certain varying opinions of the utility of this or that procedure are bound to exist, but time, experience and the careful analysis of groups of cases will for suppurative pleurisies develop a group of surgical methods similar in its efficiency to those developed for other major surgical procedures.

The attempt to sterilize the chest cavity by irrigations with various antiseptics is not new, but the recent introduction of the Dakin solution by the method of Carrel has again brought this method to the fore.

Here again opinions vary as to its efficacy, and it is the writers' impression that the character of the infecting organism, the character and efficiency of the drainage, and other complicating pleural and pulmonary conditions will have more effect upon the outcome of the case, the time and character of the healing, and the eventual result than will the effect of sterilization of the chest cavity by this or any other method of sterilization.

To get the proper perspective upon this subject means a careful examination of the results of those who use the method properly, compared to those who do not use it or parallel series in the hands of the same observer. Just at present there seems to be too much taken for granted on both sides of this question.

When drainage of the chest is contemplated certain factors must be considered, and it is difficult to speak with authority concerning that which is the most serviceable.

The situation which seemingly has been most serviceable for drainage has been the region of the eighth rib in the posterior axillary line.

In drainage of the chest the relation of the size of the drainage tube opening to the opening into the trachea (cross-section of drainage tube to the cross-section of the opening into the glottis) must be considered.

A tube sufficiently large to allow for drainage is essential, but the tube should not be as large as the glottic opening. If the tube is as large as or larger than the glottic opening, collapse of the lung is inevitable, and unless the mediastinum is fixed by the inflammatory process the opposite

lung will be hindered in its proper expansion and respiration will be seriously hampered. (This factor probably explains the seriousness of the open chest wounds encountered during the war and the success following the closure of these wounds.)

Furthermore, gravity alone cannot entirely drain a chest cavity. To effect drainage the pumping effect of the expanding lung and the movements of the diaphragm upon the fluid in the chest are important factors.

In so far as the writers know, no definite plan exists for measuring this relationship between the size of the glottic opening and the size of the drainage tube. A method of estimating the size of the tube to be used practiced by the writers has been of practical benefit. The size of the glottic opening is estimated by placing the thumb and first finger on the cricoid cartilage, thus obtaining roughly the diameter of the larynx. A drainage tube three-fourths the size of the diameter thus obtained gives a tube which is smaller than the glottic opening, yet large enough to produce thorough drainage.

Through such a tube the exudate drains out of the chest cavity with each inspiration, and the lung is at least partially expanded. If the drainage tube is open at its external end, air naturally enters the cavity during expiration, so that there is a constant variation in the quantity of fluid, air and expanded lung in the pleural cavity.

If the lung has retained its elasticity or is not fixed by adhesions, a constant gradual expansion of the lung occurs and this, with the upward movement of the diaphragm, tends to obliterate the cavity and to effect a cure.

Numerous methods to aid in producing this expansion or maintaining the expansion once produced have been proposed.

In brief the methods are:

1. Those which increase intratracheal tension.
2. Those which decrease the tension in the pleural cavity.
3. Those which maintain the lung expansion by preventing the entrance of air into the pleural cavity after establishing the drainage.

All are of benefit in properly selected cases and can be used in various combinations.

Of the methods used to increase intratracheal tension the Wolff bottles popularized in this country by Walter James have been the most serviceable and properly used are quite valuable. In our children's wards the small inflatable rubber balloons have proven of educational value in teaching the children to blow into the bottles later.

Various devices for producing suction in the pleural cavity have been proposed. At the New York Hospital the device for maintaining suction proposed by Kenyon and Connell (the principle of the Sprengel pump) was utilized for this purpose but did not prove efficacious, and in a number of cases had to be abandoned because of the hemorrhage produced—

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that is, the exudate under this method became blood stained and occasionally frankly bloody, while the lung expansion was not apparently increased.

The methods for obtaining drainage and at the same time preventing the entrance of air into the pleural cavity are many and ingenious. In general they may be separated into two groups:

First, some form of drainage tube with a valve which allows for the escape of the exudate with expiration and which closes with each inspiratory effort, and second, the gravity siphonage drainage method devised by Kenyon.²

This latter method has been the one used by the writer and has been most serviceable. A tube sufficiently large is selected and over this a cuff of larger tubing is placed so that it occupies the position on the drainage tube where that tube emerges from the wound. A piece of rubber dam about four inches square is then perforated at its centre and drawn over the tube—so that it hugs the drainage tube on the chest side of the rubber cuff above described. A bottle containing water, a connecting piece of glass or metal, and a long piece of rubber tubing are also prepared. At the operation the drainage tube is placed in the chest and connected with the long piece of tubing and the end of this latter tubing placed under the water in the bottle. The flange of rubber dam is fastened to the skin about the wound either by the rubber cement used in mending rubber gloves or by adhesive plaster, and this furnishes an airtight opening into the pleural cavity. With each inspiration the air which has entered the cavity during the operation is then forced out and then the fluid follows. The method has been found applicable for drainage in a simple thoracotomy, thoracotomy with rib resection, or in the more radical type of operation suggested by Lilienthal.

Drainage by this means can be maintained for from four to nine days, after which time leakage about the tube and wound irritations require its removal and open drainage is then necessary.

The reaction following the operation is markedly decreased by this method of drainage. In the seriously sick cases thoracotomy with drainage by this method may be done rapidly and with very little reaction, and a secondary operation may be undertaken later, if the above is not sufficient, with very much less danger to the patient.

To determine what had been the result obtained by the routine treatment of acute suppurative pleurisy in a civil hospital service, the records of the First Division at the New York Hospital were studied and an analysis of the cases is made in this paper.

No attempt has been made to include the chronic empyemas, and where mention is made of the chronic cases and their treatment, it is done to show the result of the preceding acute case rather than to discuss the chronic condition.

² Kenyon: *Operative Therapeutics*. Johnson, Appleton Co., 1915, vol. i, pp. 229-247.

The result has been taken from the follow-up system in use on the First Surgical Division described by Gibson.³

The records of the First Division (Cornell Division) of the New York Hospital from January 1, 1914, to January 1, 1920, show that 134 cases of suppurative pleurisy have been observed on that division. (This constitutes one-half of the entire hospital service.) Of the 134 cases, 111 were operated upon with nineteen deaths, a mortality in the operated cases of 17.1 per cent. Twenty-three cases were not operated for various reasons, such as refusal of permission to operate, patients moribund on admission, condition not recognized, or aspiration was sufficient to effect a cure. In this group are also included some cases in which the diagnosis of suppurative pleurisy is somewhat doubtful. Of these twenty-three cases ten died—a total mortality for the series (twenty-nine in 134 cases) of 21.6 per cent.

For the purposes of this paper the mortality to be considered is that after operation, or 17.1 per cent. Many of the cases in this list were in extremis upon admission, but no case was refused operation in which the diagnosis of suppurative pleurisy could be made and in which sufficient time was given to do the operation. Four cases died on the day of operation and all were critically sick at the time the operation was undertaken. This statement is made with no desire to juggle statistics, but merely to show that there was no selection of cases made to obtain favorable mortality statistics, and that the mortality of 17.1 per cent. represents that of the ordinary run of cases in a civil hospital service.

The essential principle followed throughout was to secure satisfactory drainage, and the site almost universally chosen was the eighth rib in the posterior axillary line. Two chief types of operation were used—thoracotomy in the eighth interspace or thoracotomy with the resection of the eighth rib.

TABLE I

Of the 111 cases submitted to operation:

19 Cases died	17.1 per cent.
64 Cases were cured	57.66 per cent.
9 Cases improved	8.1 per cent.
5 Cases unimproved	4.5 per cent.
14 Cases could not be followed	12.6 per cent.

111

TABLE II

Cases surviving the operation:

64 Cases were cured	79.5 per cent.
9 Cases were improved	9.78 per cent.
5 Cases were unimproved	5.4 per cent.
14 Cases could not be followed	15.2 per cent.

To determine any difference which might exist in the results obtained by thoracotomy or by thoracotomy with rib resection the two are analyzed separately in the following tables:

³ Gibson: ANNALS OF SURGERY, December, 1919.

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INTERCOSTAL THORACOTOMY

6 Cases died	13.63 per cent.
27 Cases cured	61.3 per cent.
2 Cases improved	
3 Cases unimproved	
6 Cases not followed	

—
44

THORACOTOMY WITH RIB RESECTION

13 Cases died	19.4 per cent.
37 Cases cured	55.2 per cent.
7 Cases improved	
2 Cases unimproved	
8 Cases not followed	

—
67

From the above tables it would therefore seem that thoracotomy with sufficient drainage has given a lower mortality with a higher percentage of cures, but the difference is not sufficient to establish the value of that procedure over thoracotomy with rib resection.

There was also no very marked difference in the length of the stay of the patients in the hospital, and the per cent. of cases submitted to secondary operation was practically identical for each type, so that for this series it is not possible to differentiate between the two types of procedure.

The writers prefer thoracotomy with the Kenyon type of drainage for the average case, but in this series in which the operations were done by four men the preference evidently was for thoracotomy with rib resection.

The cases submitted to operation are analyzed in the "Anæsthesia Chart" with reference to the character of the anæsthesia used.

Under the headings "No anæsthesia" and "Local anæsthesia" are included those cases so seriously ill that an anæsthetic was of secondary consideration and naturally a higher mortality is to be expected.

In all cases a preliminary hypodermic injection of morphine and atropine was given except in the very young children.

The anæsthetic selected must necessarily be one applied to the given case and be chosen to fit the operation contemplated. When a rapid drainage operation is contemplated some form of local anæsthesia will suffice. When a more extensive operation is contemplated ether alone or in combination with nitrous oxide and oxygen has given the most satisfactory results.

In our series there were thirty-two cases of suppurative pleurisy due to the pneumococcus—twenty-seven followed lobar pneumonia, two pneumonia complicating measles and three influenzal pneumonias. Of these, three cases died, a mortality of 9.3 per cent.

The fatal cases were one year, eighteen months, and two years, nine months old. One case was moribund on admission and died soon after

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the operation. The other two died of malnutrition. In the older child the first operation failed to drain properly and a second operation was done, and in this case the insufficient drainage probably was a contributing factor to the fatal outcome.

ANÆSTHESIA CHART

Type of Anæsthesia	Number of Cases	Deaths	Per cent. Mortality
No anæsthesia.....	5	2	40 per cent.
Anæsthesia not mentioned.....	1	1	100 per cent.
Local anæsthesia infiltration.....	14	3	21.4 per cent.
Ethyl chloride.....	7	1	14.2 per cent.
Ether.....	62	9	14.5 per cent.
Ether combination.....	14	2	14.2 per cent.
Nitrous oxide.....	4	0	0
Gas oxygen.....	4	1	25 per cent.
	111	19	17 per cent.

Of the twenty-nine cases which recovered, four cases could not be traced after their discharge. One of these cases was removed from the hospital while still quite sick, against advice, and three were discharged cured with small superficial sinuses which still required dressings.

Of the twenty-five cases followed, twenty were excellent results with normal chest expansion. Four cases had some limitation of expansion on the affected side and in one case the result is stated as an excellent result, but no mention is made of the chest condition. Seven of the above cases were submitted to secondary operation, four for insufficient drainage, two for necrosis of the rib, and one for an acute suppurative myositis about the drainage wound.

Intercurrent diseases occurred in seven cases, measles in one, otitis media in three, abscess of the buttock in one, chicken-pox in one, phlebitis in one. Three of the cases had chronic valvular heart disease and one was a chronic alcoholic previous to the present disease.

From this analysis it can be seen that the mortality for this series was confined to the young infants, that a satisfactory result as regards chest expansion was obtained in 80 per cent. of the cases, and that some slight deformity of the chest (limited expansion) occurred in 16 per cent.

Thoracotomy with rib resection was the operation of choice. Two cases died when this was used and one when thoracotomy alone was practiced. The differences between the two operations are not sufficient to give any preference to one or the other.

Dakin's Solution was used by the Carrel method in four cases and no appreciable difference in the time of cure or in the result obtained could be noticed.

Kenyon drainage was used for three cases. There was no appreciable difference either in the result of the drainage as to the final result, time of discharge, or in the condition of the patient after the operation. This

TREATMENT OF ACUTE SUPPURATIVE PLEURISY

was rather interesting to one of us (Hitzrot) as a result of this study, as the impression in that observer's mind was that there was a distinct benefit to be obtained by this method applied to all types of chest drainage.

The chief aim of the operation for this type of infection for this series must then be said to be, to obtain and maintain sufficient drainage, and when this was done the various modifications and additions to the treatment seemed in no way to affect the result.

There were twenty-two cases of suppurative pleurisy from which the streptococcus was isolated.

The bacteriological report simply states streptococcus in seven, streptococcus viridans in five, streptococcus haemolyticus in ten.

The preceding condition is stated to have been pneumonia in ten of these cases, influenza-pneumonia in four, broncho-pneumonia in two, tuberculous broncho-pneumonia in one, measles-pneumonia in two, pneumonia after tonsillectomy in one, pleurisy in one, infarct of lung following appendectomy for acute appendicitis in one.

In the three fatal cases the suppurative pleurisy was a complication of a preceding disease in two cases, in one tuberculous broncho-pneumonia, in the other acute appendicitis with abscess formation and infarct of the lung on the tenth post-operative day.

Of the nineteen cases which recovered two could not be followed long enough to determine the final result. One was discharged on the thirty-first day after operation in excellent condition, in the other at the three months interval there was a small superficial sinus which was still discharging, and the patient disappeared.

Of the seventeen cases followed twelve were excellent results with normal chest expansion. In four cases there was distinct limitation of expansion with thickened pleura. In one case (the patient with tuberculous pleurisy) the patient is still under treatment at another hospital with a discharging sinus and the condition is reported as unsatisfactory.

Five of the above cases were submitted to secondary operations before a cure was obtained. (One was the failure classed as unsatisfactory result (v. supra), and the specimen removed from the pleura in this case showed numerous tubercles.) In one case revision was done twice because of insufficient drainage with closure of the sinus, and the condition was stated as excellent at the five-months interval. In one case drainage was insufficient, due to adhesion of the lung about the abscess tract, and healing was obtained only after decortication and mobilization of the lung with excision of the sinus which ran to what evidently had been an abscess of the lung with a localized pleurisy partially walled off and which later ruptured and produced a general pleural infection.

In two cases, both with abscesses of the lung, a number of operations were necessary to effect a cure, and in one case included a lobectomy for bronchiectasis followed by a bronchial fistula for eighteen months, which eventually closed and the patient has remained well at the four-year

interval. One was a partial lobectomy for the excision of a thick-walled abscess on the posterior surface of the periphery of the lower lobe with mobilization of the lung and excision of the old drainage tract.

The intercurrent conditions were abscess of the submaxillary region one, otitis media one, acute rheumatic fever one.

Two cases had a fairly definite pulmonary tuberculosis which antedated the suppurative pleurisy.

The low mortality in this series, especially in the influenza cases, is undoubtedly due to the fact that aspiration was so consistently practiced by the medical staff before the transfer of the patients to the surgical side and also to the fact that the critically sick patients during the epidemic of influenza did not reach the hospital. Such cases as did come to the surgical side were, therefore, selected cases in the sense that they had survived the original condition and were better surgical risks than the cases reported from the army hospitals. (See report Empyema Commission.)

Thoracotomy with rib resection and open drainage was again the operation most resorted to. The reaction from the operation apparently was somewhat less in those cases in which thoracotomy with Kenyon siphonage drainage was used. One of the cases was submitted to the operation described by Lilienthal and for that particular case the operation proved most efficacious, and a simple drainage operation would not have been suitable. (The decision to use that type of operation was based upon the X-ray examination and showed a localized process communicating by a narrow tract with the general cavity.)

Dakin-Carrel irrigation was used in five of the cases without any appreciable result except that of deodorizing the secretion in two of the cases.

The one fact that stood out in the cases of streptococcus pleurisies in this series was that the process was a more complicated one than that due to the pneumococcus, and that the result of the surgical treatment as well as the choice of the operation depended upon the underlying lung involvement. Where this was slight the cases recovered in about the same time as the pneumococcus cases and the essential feature was sufficient drainage, and the various modifications had no very practical significance.

When the underlying lung or pleural condition was tuberculous the result was unsatisfactory, as are many of the surgical forms of tuberculosis. In the cases with more extensive lung involvement (lung abscess plus extension into the pleura or into the bronchi) the drainage of the pleural process had to be supplemented by further operation to effect a cure.

The organism in twelve cases was reported as staphylococcus in one, staphylococcus albus in five, staphylococcus aureus six.

The preceding condition is stated to have been pneumonia in five cases, measles-pneumonia in one case, broncho-pneumonia in one, influenza-pneumonia in four cases, and not stated in one case.

Two cases died (one of the pneumonias, and the broncho-pneumonia):

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Of the ten cases which recovered two could not be traced after their discharge. (One improved, one cured, at the time of discharge.)

Three cases are reported as excellent at varying periods after the three-months interval.

Two cases were reported as in hospitals with chronic pulmonary tuberculosis. One case had an excellent chest condition, but is under treatment now for an acute osteomyelitis of the left tibia (*staphylococcus aureus* in both conditions). One case died two months after discharge of meningitis, one case is still under observation—nine-months interval with a discharging sinus, due to osteomyelitis of the rib, with limitation of chest expansion, but is improving slowly.

Three cases were submitted to secondary operation chiefly because of failure of the sinuses to close, and the secondary operations were those for chronic empyema, in one an enlargement of the drainage opening with satisfactory cure, in two chest collapsing operations, one with a satisfactory cure, and one which still has a discharging sinus.

In this group as in the streptococcus group, one is impressed by the fact that the underlying lung condition and the character of the infecting organism have an important influence upon the outcome of the case.

In this series late complications and sequels (such as acute osteomyelitis, osteomyelitis of the rib, meningitis, etc.) have been more common than the pneumococcus infection.

There were seven cases in which the bacteriological report does not identify the organism sufficiently to place it in any of the above groups (that is, the report states Gram-positive cocci, Gram-positive diplococci, Gram-positive diplococci with capsule, etc.).

While it was possible to conjecture what was meant, it seemed wisest to the writers to place these cases in a separate group.

The preceding condition is stated as pneumonia in four, not known in two, and measles-pneumonia in one case.

Three cases died, all of which were pneumonias. One of the fatal cases had a complicating gastroenteritis, and one had a serofibrinous pleurisy on the opposite side.

Of the four cases which recovered one case was discharged cured but could not be traced. Two had excellent results and one case had a discharging sinus with limited chest expansion after two and one-half years. This last case had three secondary operations, the first for insufficient drainage, and the other two for a chronic empyema.

In twelve cases the culture from the chest was reported as sterile. The preceding condition is stated as pneumonia in eight, influenza in one, pleurisy in one, measles-pneumonia in one, perforated gastric ulcer in one.

Four cases died, three of which were pneumonias. One was practically moribund on admission and died soon after the operation, two had pericardial effusions which were aspirated, one died of a diffuse

peritonitis with perforation of the intestines. The suppurative pleurisy in this last case was a complication of a perforated ulcer in the pyloric region.

Of the eight cases which recovered, one could not be traced, five had an excellent result, one had signs of thickened pleura, one had an asthmatic cough which had existed previous to the empyema with râles over the affected side of the chest.

Two of the above cases were submitted to secondary operations because of insufficient drainage. (In one case the tube had fallen into the chest.) Both cases were satisfactory recoveries.

In twenty-four cases there was no bacteriological report on the chart. (Many of these were cases during the disorganization at the beginning of the war.)

The preceding condition is stated as pneumonia in fourteen cases, influenza in four cases, pleurisy in two cases, acute appendicitis in two cases, chicken-pox in one case, and in one case the preceding condition could not be determined.

Four cases died (three were pneumonias). One died shortly after the operation and two died with complicating conditions elsewhere than in the chest (otitis media, abscess of the thigh). One case was an acute appendicitis with suppurative pleurisy which died the day after the operation for the later condition.

Of the twenty cases which recovered, one case died six weeks after discharge from the hospital of meningitis, and one died three months later of intestinal obstruction. (This case was originally an acute appendicitis complicated by suppurative pleurisy and abscess of the liver.) Thirteen cases are reported in excellent condition with no lung signs, one had thickened pleura on the affected side, four were discharged with a discharging sinus and could not be traced.

Five of the above cases were submitted to secondary operations. In three the drainage wounds were allowed to close too rapidly and had to be reopened on the twenty-first and twenty-third and twenty-fifth post-operative days. In one case the patient was well for five months and was then readmitted ten months after the first operation with a suppurative pleurisy on the same side. In one case (one of the pleurisies) a secondary operation was done, evidently for unsatisfactory drainage, and the description of the condition suggests that the underlying disease was tuberculous, but there are no definite statements. (The case was one that left the hospital with a discharging sinus and could not be traced.)

In one case the fluid aspirated from the chest was stated as thick pus and the bacteriological report was bacillus typhosus in pure culture. The case is of sufficient interest to report in detail.

The patient, an Italian aged forty-one years, was admitted to the First Medical Division (Doctor Connor's service) of the New York

TREATMENT OF ACUTE SUPPURATIVE PLEURISY

Hospital, February 19, 1920. His chief complaints were cough, pain in the right chest, fever and weakness. The onset was characterized by general malaise, pain in the back and legs, headache and cough with no sputum.

His condition has steadily grown worse and the pain in the right chest has slowly increased.

Physical examination showed a man who looked sick, was apathetic and unresponsive. Examination gave dullness and the signs of fluid on the right side. The spleen was barely palpable. The temperature on admission was 103° ; pulse, 100; respiration, 20. Blood: Hæmoglobin, 56; red blood-cells, 3,176,000; white blood-cells, 8000, with 65 per cent. polynuclear cells.

(Doctor Connor expressed the opinion that the patient had the appearance of a patient with typhoid.)

Aspiration of the right chest on the day after admission removed 500 c.c. of frank pus, which on culture revealed the bacillus typhosus in pure culture. Aspiration on the fifth day after admission again gave pus. X-ray on second day after admission showed fluid (pus) in right chest (Doctor Busby).

Operation (February 24, 1920, five days after admission).—Thoracotomy with Kenyon siphonage drainage. Doctor Hitzrot, novocain infiltration anæsthesia, incision in seventh interspace in posterior axillary line, sufficiently large to admit a large rubber tube. Kenyon siphonage drainage. A large amount of pus escaped into the bottle. Kenyon drainage for nine days—saline irrigations caused chill. Later Dakin-Carrel irrigations which could not be continued because of coughing; discharged sixty-nine days after operation with chest wound healed except for small superficial granulating area.

The temperature curve, pulse, and respiration showed nothing of moment and resembled the period of steep curve seen in the typhoid charts.

Widal and blood cultures were negative.

(Bacteriological Report.—The culture from the chest fluid shows a growth of a Gram-negative bacillus which is motile and which has the cultural characteristics of the bacillus typhosus. It is agglutinated by antityphoid serum in dilutions of 1-1000-1-5000.)

SUMMARY

1. In the cases of suppurative pleurisy due to the pneumococcus proper drainage instituted early and maintained long enough produced a satisfactory cure.
2. In the cases of suppurative pleurisy due to the streptococcus there were more underlying lung conditions (abscess, etc.) which required more varied treatment, and secondary operations were more frequent.
3. The average stay in the hospital for the uncomplicated cases in this series was thirty-two days. This includes the case due to the bacillus typhosus but not the deaths, the unsatisfactory results, or the cases submitted to secondary operations.

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(Doctor Connor expressed the opinion that the patient had the appearance of a patient with typhoid.)

Aspiration of the right chest on the day after admission removed 500 c.c. of frank pus, which on culture revealed the bacillus typhosus in pure culture. Aspiration on the fifth day after admission again gave pus. X-ray on second day after admission showed fluid (pus) in right chest (Doctor Busby).

Operation (February 24, 1920, five days after admission).—Thoracotomy with Kenyon siphonage drainage. Doctor Hitzrot, novocain infiltration anæsthesia, incision in seventh interspace in posterior axillary line, sufficiently large to admit a large rubber tube. Kenyon siphonage drainage. A large amount of pus escaped into the bottle. Kenyon drainage for nine days—saline irrigations caused chill. Later Dakin-Carrel irrigations which could not be continued because of coughing; discharged sixty-nine days after operation with chest wound healed except for small superficial granulating area.

The temperature curve, pulse, and respiration showed nothing of moment and resembled the period of steep curve seen in the typhoid charts.

Widal and blood cultures were negative.

(Bacteriological Report.—The culture from the chest fluid shows a growth of a Gram-negative bacillus which is motile and which has the cultural characteristics of the bacillus typhosus. It is agglutinated by antityphoid serum in dilutions of 1-1000-1-5000.)

SUMMARY

1. In the cases of suppurative pleurisy due to the pneumococcus proper drainage instituted early and maintained long enough produced a satisfactory cure.
2. In the cases of suppurative pleurisy due to the streptococcus there were more underlying lung conditions (abscess, etc.) which required more varied treatment, and secondary operations were more frequent.
3. The average stay in the hospital for the uncomplicated cases in this series was thirty-two days. This includes the case due to the bacillus typhosus but not the deaths, the unsatisfactory results, or the cases submitted to secondary operations.

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	Number of Cases	Preceding Disease	Cases	Deaths	Not Traced	Excellent	Some disturbance of chest function not healed, etc.	Secondary Operations	Remarks
Pneumococcus	32	Pneumonia	27	3	4	20	5	7	Chiefly for insufficient drainage
		Measles	2	..	..	..	..
		Influenza	3	..	..	..	..
		.....	..	(9.3)	..	(62.5)	..
Streptococcus	22	Pneumonia	10	1	5	Chiefly for underlying lung conditions.
		Influenza	4	..	..	..	..
		Broncho-pneumonia...	2	..	2	12	5		
		Measles, pneumonia ..	2	..	..	..	..
		Tuberculosis, broncho-pneumonia	1	1	..	..	..
		Pneumonia after tonsillectomy	1	..	..	..	..
		Pleurisy	1	..	..	..	..
		Infarct	1	1	..	..	..
Staphylococcus	12	(13.6)	..	(54.5)	..	3	Lung abscesses.
		Pneumonia	5	1	..	..	..
		Measles, pneumonia ..	1	..	2	4	4		
		Broncho-pneumonia ..	1	1	..	..	..
		Influenza-pneumonia..	4	..	..	..	..
Organisms not sufficiently identified...	7	?	1	3	Chronic empyema.
		.....	..	(16.6)	..	(33.0)	..
		Pneumonia	4	3	1	2	1		
		Unknown	2	..	..	..	..
Sterile	12	Measles, pneumonia ..	1	3	Chronic empyema.
		.....	..	(33.0)	..	(41.0)	..
		Pneumonia	8	3	1	5	2		
		Influenza	1	..	..	..	..
		Pleurisy	1	..	..	..	..
No report	24	Measles, pneumonia ..	1	2	Insufficient drainage.
		Perforated gastric ulcer	1	1	..	..	..
		.....	..	(33.0)	..	(41.0)	..
		Pneumonia	14	3	..	..	..
		Influenza	4	..	..	..	..
Bac. typhosus	1	Pleurisy	2	3	Insufficient drainage.
		Acute appendicitis...	2	1	4	13	3		
		Chicken-pox	1	..	..	..	..
		Unknown	1	..	..	..	..
		.....	..	(16.0)	..	..	..
Diphtheroid bacillus	1	?	1	1	..	1	Insufficient drainage.
		Pneumonia	1	..	..	..	..
		Cardiovascular disease with decompensation	1		
III			III	19	14	57	21		

DUODENAL ULCER IN INFANCY

By DUDLEY WHITE PALMER, M.D.

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IF THE diminutive size of the bibliography of this subject be a criterion as to the rarity of duodenal ulcer in infancy, then it should rank amongst the most rare of diseases. However, a study of even this scant bibliography leads one to the conclusion that here, as so often is the case, this condition will be found less and less rare as one looks for cases; it is perhaps more unlooked for than uncommon. A majority of the text-books of pediatrics either do not mention the condition at all, or in a very few words pass it over as one of the causes of melena neonatorum. Even Moynihan in his monograph on "Duodenal Ulcer" gives as a title to his chapter on ulcer in infants, "Melena Neonatorum and Duodenal Ulcer."

L. Emmet Holt, in December, 1913, collected ninety-one cases in the literature and added four of his own. Seventy-four of these cases were published after 1908. In reviewing this literature it is interesting to note that one clinical feature, hemorrhage, is made to stand out preëminent and a necessity to diagnosis. One who has seen much of ulcer in adults cannot help but feel the building up of a diagnosis about one complicating symptom is a mistake, for in the ulcer of adults not over 40 per cent. of cases give a history of hæmatemesis or bloody stools, and it is difficult to see that hemorrhage is any more necessary to the making of a diagnosis in infants than in adults.

A study of forty-five case histories that I have been able to chart from the literature showed twenty-five males with an average age of about three and a half months. Practically all of the cases showed a more or less marasmic condition, though of a great many of the cases it is stated they had had a good start, often breast-fed, and but few dietetic errors had been present.

Helmholz and Gerdine, after a thorough study of the reported cases, and a careful bacteriological study of the ulcers found in eleven cases in their own clinic, came to the conclusion that the ulcers were of infectious origin occurring most commonly in epidemic form, and that a diplococcus or streptococcus was the invader. From one case a pure culture of streptococcus viridans was obtained, and this, injected into dogs and rabbits, produced ulcers of the duodenum in the hosts. It seems that the fundamental factor in the production of these ulcers is as in all ulceration, an infection. From the case histories it would seem that a debilitated state of health favored the infection. Not a few of the articles offer the ulcer as a complication of the marasmic, atrophic, anæmic condition and not a distinct entity. In no case in the literature is the cause attributed to burns.

With an average age incidence of three and a half months, and but

five of sixty-five cases being over five months old, one is struck by the uniformity of the age of these babies. As before mentioned, the history of gross dietetic errors is usually absent and was in the case I later report; not infrequently the babies have had the scientific care of a competent pediatrician, and the nutritional disturbance preceding the terminal complication of hemorrhage has seemed out of proportion to the dietetic fault. In fact, acute gastrointestinal disturbance is usually absent.

The vomiting is often severe and persistent, being irregular at times or assuming the type seen in true congenital pyloric stenosis of infants. In a canal whose lumen normally is not much larger than a lead pencil it can be readily understood how an ulcer just distal to the pylorus might produce sufficient irritation to cause a reflex spasm simulating pyloric stenosis even though no hyperplasia of the muscle existed. Vomitus was of soured food not containing blood, as a rule, until near the end of the scene; a majority of those that showed hæmatemesis or large, tarry stools died in thirty-six to forty-eight hours. It is surprising how little blood these young babies can afford to lose without dying. Not infrequently the vomiting has led to a diagnosis of congenital stenosis with and without confirmation of this diagnosis at autopsy. Rarely has the tumor of pyloric stenosis been found associated with ulcer, and the same may be said of gastric waves. If one will bear in mind that pyloric stenosis is essentially a disease showing itself in the first weeks of life, while ulcers come in the second to six months, there will be less confusion. Symptoms resembling stenosis appearing after two months should put one on his guard for ulcer as the more probable explanation of the symptoms.

There is, not infrequently, the usual evidence of pain shown by the crying, facial expression and drawing up of the knees. Bloody stools have been a common terminal symptom and, in fact, the few cases diagnosed clinically were so diagnosed upon appearance of bloody, tarry stools, in the absence of acute ulcerative colitis. Occult blood may be found in the stools when not macroscopically present, and it seems that it would be wise to examine the stools for occult blood in any case of unexplained vomiting continuing over a period sufficiently long to produce an atrophic condition.

Associated with these symptoms, of course, are all the symptoms of a bad nutritional disturbance, loss of weight, anæmia, dehydration, sunken fontanelles, subnormal temperature, suppression of urine, etc. The duodenal tube has been used for diagnosis several times and seems of value, but must be used with extreme care, as these ulcers are but poorly protected and not a few of the deaths in the reported cases were due to a natural perforation of the ulcer. Perforation did not follow the use of the tube in the recorded cases.

Of the forty-five cases I have charted, a correct clinical diagnosis was made or suspected in but ten, so it is very evident there is much room for improvement in diagnosis. The X-ray has been suggested, but not used

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as far as I know, and it seems that the X-ray might be of great value in the diagnosis if used in those cases of vomiting of infancy of obscure origin not responding to the usual dietary measures.

The ulcers of infancy may be single or multiple; they are usually just distal to the pylorus, but may be as far down as the papilla of Vater; the latter location is as rare as in the adult. Thirty-two of forty-five cases were in the first part of the duodenum and in sixteen instances the ulcers were multiple. No cases are reported with the ulcer below the papilla. This rather conclusively demonstrates that in addition to other etiological factors the chemical condition of the tract plays a big factor in the ulcer development. These ulcers may represent a superficial necrosis of the mucosa or show necrosis of all layers of the wall so that perforation occurs: a potential perforation has been plugged by the pancreas or omentum in rare instances. The ulcers range from small multiple erosions, the size of a pinhead, to large single or double ulcers, $1\frac{1}{2}$ centimetres long.

An absence of round-celled infiltration seems characteristic of these cases; any induration is rather more oedematous than inflammatory. Not infrequently a few clots of blood are adherent giving evidence as to the source of the hæmatemesis or bloody stools. A large majority of these ulcers are described as being on the posterior wall of the duodenum. The edges may be sloping rather than undermined, or in a few instances they are described as sharply defined and having a punched-out appearance. Associated pathology has consisted of cicatricial stenosis, congenital stenosis, nephritis, marked eczema, peritonitis local and general, fatty liver, pulmonary tuberculosis, jaundice, pneumonia, pus meningitis, colitis, melena neonatorum, marasmus, and emaciation.

The source of our knowledge of infantile duodenal ulcer being almost entirely the autopsy room, our ideas of prognosis will naturally be correspondingly colored. Certain it is that massive bleeding warrants a very poor if not promptly fatal prognosis. There are a few cases, however, that have been observed and diagnosed clinically that have gotten well, so that one wonders if they do not occur much more frequently than we have suspected in the past.

Well-healed scars have been found and in one instance the ulcer was quite well healed one week after a severe hemorrhage. It would seem that the majority of the ulcers are of an acute type. On the whole the prognosis must be considered poor, because of the associated nutritional disturbances and the well-known poor way an infant stands the loss of even small amounts of blood. Certainly the fact that most of the case reports in literature are accompanied with autopsy reports speaks but too plainly of the prognosis under the treatment used to date, and some radical change in the treatment is indicated. Perhaps not a few of the marasmic cases of unexplained etiology that ultimately improve and finally develop satisfactorily, are unrecognized ulcer cases. This paper

is, therefore, a plea to bear in mind this condition in these marasmic infants and so be in a receptive frame of mind toward this diagnosis should any suggestive symptoms present themselves.

On the consideration of the diagnosis of duodenal ulcer in the living infant one must bear in mind ulcerative colitis, chronic intussusception of the bowel, true congenital pyloric stenosis, swallowed pins or other foreign bodies, those marasmic and atrophic conditions not associated with ulcer, and that condition of melena neonatorum where the findings are multiple small ulcers throughout the intestinal tract. The post-mortem findings of ulcer must not only rule out the above, but also the post-mortem superficial necrosis or digestion that undoubtedly occurs rather rapidly in the poorly nourished.

Veeder says: "Surgical interference has not been deemed advisable in any of our cases, owing to the general nutritional disorder of the infants at the time diagnosis was made." His cases showed 100 per cent. mortality. He further adds: "If methods are found by which an ulcer can be recognized early, surgical treatment offers at least a theoretical possibility."

While it is presumptuous to draw conclusions from one case, it seems that in a condition as universally fatal as the reported cases in literature would indicate, some other more radical method of procedure is justifiable. In case of gross hemorrhage certainly a blood transfusion should be first indicated. A posterior gastrojejunostomy would then seem of value, where the exploration confirms the clinical diagnosis, as this operation is not only a drainage operation, but it alters the chemistry of the acid stomach. It would seem that the high percentage of complicating hemorrhage cases should alter one's attitude toward the use of any palliative methods of treatment.

The following case report, so far as I can determine from a rather careful search of the literature, is the first case of duodenal ulcer in infancy to be operated upon, and that successfully.

CASE REPORT. *Duodenal Ulcer in a Six-months-old Infant; Pyloroplasty, Followed Eighteen Days Later by Gastrojejunostomy; Recovery.* Baby E. V., male, six months old, weighed eight pounds at birth, was breast-fed for two and a half months. In the first few weeks he began spitting up food once a day or oftener and continued this until the last few months before operation when the spitting up became a true vomiting. At two months he reached a maximum weight of ten and a half pounds. Mother and baby had the "flu" when the child was about two and a half months old. Very many kinds of foods were given and after each change of food there was a temporary improvement in the vomiting; the case changed hands several times. About one month before I saw the child in consultation, Dr. E. A. Wagner took charge, and during this time very careful scientific feeding was instituted. Twice the duo-

denal tube was passed successfully. Weight fluctuated up and down until the early part of June, 1919, when the maximum weight of ten and one-half pounds was again reached only to be followed by daily loss of weight for nearly a week. Vomiting was worse rather than improved in spite of all the attention and care, and notwithstanding the days of apparent improvement the general average of his condition was much lower. The child was marasmic, dehydrated and more or less apathetic; the urine was scant, but the stools showed some food. At times the stools had been green and of deficient quantity. No one had seen blood in the stools, but tests for same had not been made. Hæmatemesis had not been noted. The X-ray showed a small, active stomach with about a normal emptying time. The character of the duodenal cap was not mentioned in the radiographer's report, and unfortunately the plates have been lost. On one or two occasions it was thought by Dr. Edward Wagner that peristaltic gastric waves were present, and at the time of my consultation it seemed that a wave could be outlined, though the mother says she and the father frequently looked for waves but never saw one. Certainly they were never definite as in the true case of congenital stenosis. Medical effort was failing to improve the condition and the child was rapidly losing weight, with a hot summer in prospect. A tentative diagnosis of congenital pyloric stenosis of a mild, persistent type was made and operation advised and accepted. At this time the child was six and two-thirds months old and weighed eight pounds and six ounces (six ounces over birth weight).

After one day's preparation with hypodermoclysis of normal salt solution and glucose and soda per rectum, the abdomen was opened at the Good Samaritan Hospital, June 20, 1919, Dr. Clyde Shinkle giving an ether anæsthetic. To our surprise no pyloric tumor was present. The pylorus was of normal thickness, but about one-half inch distal to the pyloric ring there was attached a tag of omentum plastered over an area of the peritoneum distinctly "stippled" and puckered as is the case in ulcers of adults. The child's condition was so bad a gastroenterostomy seemed out of the question, and a pyloroplasty operation was substituted, splitting the pylorus and suturing it up in the opposite direction to widen the lumen. The child reacted well, took some nourishment the first few days, vomited a few times, a bile-stained vomitus for the first time, and slightly more than held his own, so that by July 7th he weighed nine pounds. But the vomiting was becoming worse and food seemed to accentuate the vomiting. It seemed the lumen created by the pyloroplasty operation was insufficient, and I advised the parents to permit the more formidable gastrojejunostomy. I must confess I hoped they would refuse. Consent was again given and a rapid, short-loop, posterior suture gastrojejunostomy was made on July 8, 1919. This operation was very successful. I feel quite sure the pyloroplasty operation paved the way for the gastro-

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jejunostomy, and also I am convinced the latter operation as the primary operation would have resulted fatally. The child gained steadily, and when sixteen months old he weighed twenty-four pounds and was a fine-looking child in every way. In doubling his age he tripled his weight. Now at the age of two years he weighs thirty-two pounds and is normal in every way.

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LINITIS PLASTICA

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IN THIS report the author purposes to consider, somewhat cursorily, the salient diagnostic and pathologic problems of linitis plastica. In general, the unsolved problems of stomach pathology, of which linitis plastica is a striking example, are of vital importance to the surgeon, especially when the question of the selection of a particular operative technic demands an immediate decision. In gastric ulcer, for example, this is well illustrated. The unknown pathogenesis of ulcer and its relation to carcinoma are mooted questions, to the solution of which any discussion of a problem of stomach pathology of surgical interest, must throw some light, however feeble. Incidentally, a knowledge of the occurrence and recognition of linitis plastica may possibly aid in the explanation of those not unusual instances of pyloric tumor in which later investigations or even autopsy disclose complete disappearance of the tumor, despite the fact that the growth was left either untouched or relieved merely by a palliative procedure.

CASE REPORT.—Male, aged fifty-one years. Admitted to the Rock-away Beach Hospital, December 3, 1919. Discharged January 1, 1920. Occupation, plumber.

Family History.—Close questioning fails to reveal that any member of the family suffered from diabetes, nephritis, carcinoma or tuberculosis. His father died of "chronic indigestion," at the age of sixty-nine years, following a period of emaciation. Brothers and sisters alive and well.

Personal History.—Polyuria three to four times a night. Smokes about twenty cigarettes a day; uses alcohol in moderation. His usual weight is one hundred and thirty pounds; at present he weighs one hundred and four, having lost approximately twenty-six pounds in one month. Habits regular. Denies venereal disease. In childhood suffered from measles, whooping-cough, mumps and diphtheria. Never been operated on. No history of any accident.

Chief complaint is the occurrence of pain in the epigastrium. This pain was first noted twelve years ago; is of excruciating character. For about one month previous to operation the pain has become exceedingly oppressive. It is confined to the umbilical region. Recently the pain has appeared one-half hour after meals. Nausea and vomiting constantly present.

Physical Examination.—Eyes are negative, save for myopia. Slight deafness in the left ear. A small polypus is present in the

nose. Heart and lungs negative. Examination of the abdomen fails to reveal any tumor or mass. The patient is a thin man, with marked evidence of loss of flesh. His chief complaint is abdominal pain in epigastrium. Urinalysis, negative. Wassermann examination, negative.

X-ray Report (September 10, 1919).—M. B. Bernstein, M.D. The stomach was large, dilated, hypotonic in type, presenting a hyperperistalsis; there was a definite, persistent defect at the pylorus. The six-hour examination showed a very large residue, indicating marked obstruction at the pylorus. The conclusion was that the patient had a chronic calloused ulcer at the pylorus with early malignancy.

Operation (December 6, 1919, Rockaway Beach Hospital).—Ether narcosis. An incision was made in the median line of the epigastrium. On opening the abdomen there was found a large tumor situated at the pyloric end, extending along the lesser curvature of the stomach. Several glands in the lesser omentum were distinctly involved. The liver appeared smooth to palpation. As there existed considerable mobility of the tumor without excessive lymphatic involvement, resection was decided upon. A typical partial gastrectomy of the Billroth No. 2 type was performed. The continuity of the intestinal tract was restored by supplementing the operation with a posterior gastrojejunostomy of the no-loop antiperistaltic type. In performing the gastrectomy the duodenal stump was closed with three layers of sutures. First, a running chromic catgut No. 2; second, a Cushing linen suture; third, interrupted linen sutures. The stump of the duodenum was brought in close approximation to the pancreas, following the advice of Willy Meyer.

The stomach was divided in an oblique manner and the opening closed with three layers of sutures. First, a running, inverting, chromic catgut suture No. 2; second, a Cushing linen suture; third, interrupted, mattress, linen sutures. The technic employed in the gastrojejunostomy was that recommended by William Mayo. At the conclusion of the operation a thin cigarette drain was placed through the upper angle of the incision and passed to the stump of the stomach. The abdomen was closed in layers. The duration of the operation was one hour and fifteen minutes. The patient's condition was excellent; pulse was about 80, full and strong.

Uneventful recovery. The drain was withdrawn promptly. Removing the sutures disclosed primary union. Patient was discharged from the hospital cured. At the present writing he is in splendid health and has completely regained his original weight and has resumed his work.

Pathological Report.—Ray S. Nelson, M.D. On examination of the gross specimen the tumor appears as a white, thick, intensely hard mass. On closer investigation it seems to involve the entire portion of the stomach removed. It would appear to have existed originally on the pylorus and extended downward on both the anterior and posterior walls of the stomach.

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Microscopical examination reveals a very definite formation of fibrous tissue, some of which is extremely dense beneath the muscular layer. The fibrous tissue penetrates and involves the muscular layer and extends to the serosa. The mucous membrane is absolutely normal. The tumor is not carcinoma, sarcoma, myoma or a gumma. It should be classified, most likely, under the heading of linitis plastica. The slides of this specimen were shown to John Larkin, M.D., Pathologist, City Hospital, who concurred in the above diagnosis.

For an elaborate and detailed discussion of the history, etiology and pathology of this rare disease, one should consult the excellent statistical and analytical article of H. W. Lyle, published in the *ANNALS OF SURGERY*, 1920. A complete bibliography is there furnished. It may suffice to say here that the term linitis plastica was first devised and applied by Brinton, who definitely established the disease as a lesion, distinct and peculiar to the stomach. Though, before the time of Brinton, there were desultory reports scattered throughout the literature, these reports and cases lacked the sufficient and determining clearness necessary to stamp the disease as a clinical and pathologic entity. Moreover, the pathologic and microscopic records of the earlier cases are necessarily uncertain because of the then inadequate examinations.

The descriptive term, linitis plastica, applied by Brinton, etymologically, is of Greek origin. It refers to and describes the delicate and interlacing connective tissue of the submucosa so peculiar and characteristic of the lesion. Since the time of Brinton numerous authors have contributed clinical and pathological monographs in which are employed a multiplicity of descriptive terms. Among the more common of these are, chronic interstitial gastritis, sclerosis of the stomach, submucous hypertrophy, neurofibromatosis, etc. Naturally, this diversity of nomenclature illustrates vividly the mysterious and baffling nature of the disease. Indeed, the unknown elements of the disease have given rise to considerable speculation as to its causation and intrinsic nature. The subject has been approached by the internist, the pathologist and the surgeon, all of whom have advanced numerous theories. Senility, arteriosclerosis, tuberculosis, lymphatic obstruction, sarcoma, infiltrating epithelioma and diffuse carcinoma have been suggested as the essential elements. It is generally and indeed firmly believed, however, at the present time, that the disease is in no way related to carcinoma or sarcoma, but is, essentially, a peculiar and benign form of fibrosis.

The stomach as a whole is generally contracted and rigid, and presents a somewhat mottled appearance. The walls are excessively thickened and inelastic. Pyloric stenosis is unusual. The obstruction is caused by a gradual and uniform narrowing and approximation of the walls of the stomach. The thickness is mainly caused by the prodigious expansion of the submucosa. The muscularis and serosa take but a minor part in

producing the thickening, since the increase of connective tissue in the submucosa is the vital and dominant factor.

The striking histologic finding is the extreme hypertrophy of the connective tissue of the submucosa. The characteristic appearance of the connective-tissue fibrils, displayed by profuse and intimate interweaving, is especially distinctive and characteristic. These connective-tissue fibres exist in the form of swirls that invade and occupy the muscularis, and indeed extend to the serosa. Yet, despite this marked alteration of the submucosa the border of the mucosa remains intact and uninjured. This smooth and undisturbed appearance of the cylindrical cells of the free surface of the mucosa is especially emphasized by Lyle. He maintains that the absence of necrosis or ulceration of the mucous membrane is a striking and pertinent point. Of course, from excessive pressure of the newly formed elements in the submucosa, the mucosa may become thickened or even atrophied, with the development, occasionally, of dilated or cystic gastric tubules. The changes, however, are extremely insignificant. This striking absence of alteration of the mucosa places the lesion in marked and special contrast to carcinoma of the stomach. For in adenocarcinoma the salient and dominant alteration is the change and growth of the cylindrical cells either covering the surface or lining the ducts and glands.

The actual diagnosis is usually made by the pathologist. A correct pre-operative diagnosis is practically impossible, though it is interesting to note that Osler had the distinction once of diagnosing the condition. The symptomatology is in no way clear. Indeed, it is difficult to record a precise clinical train of symptoms. In general, the signs are vague and indefinite and resemble, more or less, those of gastric carcinoma.

The disease usually occurs in adults. A previous history of arteriosclerosis, chronic alcoholism, rheumatism and diabetes has been recorded in certain published cases. The usual symptoms noted are anorexia, vomiting, epigastric pain and tenderness, and occasionally the finding of an abdominal tumor. Vomiting is liable to become intractable. Gastric analysis does not furnish any decisive point. X-ray examination of the stomach is informative. The disease is progressively fatal unless relieved or cured by surgical operation.

The treatment is surgical. Since the diagnosis is never definitively determined until the microscopic examination has been completed, the general rules and principles underlying the surgical treatment of carcinoma of the stomach are maintained for linitis plastica. In short, if the technical conditions permit, gastrectomy, partial or complete, should be performed. If, owing to the debilitated condition of the patient, or the occurrence of extensive adhesions to the adjacent viscera, gastrectomy is not feasible, gastrojejunostomy is indicated, especially if there exist pyloric stenosis. It would appear that the latter operation is often curative. Still, the extreme difficulty in recognizing the lesion and its great

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liability to resemble carcinoma, undoubtedly, make gastrectomy the operation of choice. Moreover, the uncertain nature of the disease and its potential alteration to carcinoma furnish additional points in sustaining a decision to perform gastrectomy.

As is evident by the recital of the above case, the symptoms and X-ray picture pointed toward pyloric carcinoma. Indeed, the actual pathologic findings at the time of exploration seemed indubitably those of pyloric carcinoma. It was never doubted for a moment that gastrectomy was clearly indicated. While complete recovery of the patient supports the practice of gastrectomy, it would appear from the investigations of Lyle that a gastrojejunostomy may prove equally successful. Since from the viewpoint of actual practice it would appear extremely difficult to discriminate these instances of linitis plastica from actual carcinoma, the writer feels that from this standpoint it would be better to employ gastrectomy in these doubtful instances.

In an article in the *ANNALS OF SURGERY*, July, 1913, Alexis Thomson describes fibromatosis of the stomach and its relationship to ulcer and to cancer. He employs the term fibromatosis as synonymous with linitis plastica as described by Brinton. Other terms mentioned are cirrhosis of the stomach and fibroid induration of the stomach. The article is strictly a pathologic analysis of a certain number of specimens, personal and collected. The primary point urged by Thomson is that he is able to distinguish in the walls of the stomach ordinary or common scar tissue from the tissue characteristic of fibromatosis.

He states that ordinary scar tissue invades the entire walls of the stomach irrespective of the various layers, while fibromatosis, on the other hand, arises in the submucosa and extends into the muscularis, causing therein a peculiar segmentation of the circular muscle. It is this fundamental distinction between scar tissue and the tissues of fibromatosis upon which is based the thesis of his article. For example, he states that out of nine cases of stomach tumor in which he found fibromatosis, there were seven which presented a distinct punched-out ulcer defect, while in the remaining two there was superficial ulceration over the greater part of the affected area. Moreover, in a certain small percentage of these ulcer fibromatosis cases he found evidence of carcinoma in the stomach wall or in the adjacent lymph-nodes.

Of course, these findings are in marked contradistinction to the views above enunciated; and, if these findings are confirmed and substantiated the entire discussion would have to be reopened and the question of fibromatosis be brought in relation to ulcer. There is no doubt that this subject affords a fertile field for further investigation and study, particularly from the pathologic viewpoint. Before one can definitely close the subject it will be necessary to have specific criteria in order to distinguish between the characteristic tissue of linitis plastica and the scar tissue secondary to ulcer or carcinoma of the stomach.

THE USE OF THE DUODENAL TUBE IN THE PRE-OPERATIVE STUDY OF THE BACTERIOLOGY AND PATHOLOGY OF THE BILIARY TRACT AND PANCREAS*

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THE duodenal tube has been in use as an aid to diagnosis since 1909, when Einhorn¹ first demonstrated its clinical applicability. It is now accepted as the best means of obtaining duodenal contents for examination. Inasmuch as the stomach contents, the secretions of the pancreas, the bile and the duodenal secretion, and under certain conditions the contents of the upper jejunum, are to be found in the upper half of the duodenum, the examination of the material removed from the duodenum is open to many interpretations unless the conditions present at time of removal are known.

It has been established that in the normal individual in the fasting state the duodenum is collapsed, practically nothing passes from the stomach, very little bile enters it, and that the little fluid content present at that time is sterile. In the earlier work done with the duodenal tube little information could be obtained in the fasting state, unless the duodenum itself were diseased, or if the contents were removed in an active stage of digestion, with the stomach active the acid secretions of the stomach disturbed the duodenal contents as far as bile and pancreatic enzyme investigations were concerned.

In 1917, however, a very new and active interest was given to the study of duodenal contents from the standpoint of biliary and pancreatic disease. In April, 1917, Meltzer published a communication entitled "The Disturbances of the Law of Contrary Innervation as a Pathogenetic Factor in the Diseases of the Bile-ducts and Gall-bladder."² In a footnote at the end of his article he said, "According to the view taken in this paper, some cases of jaundice and of biliary colic have their origin in the fact that the sphincter of the common duct is abnormally contracted and does not become relaxed as it physiologically should during the contraction of the gall-bladder. In experiments with magnesium sulphate I observed that the local application of a 25 per cent. solution of that salt upon the mucosa causes a completely local relaxation of the intestinal wall, and does not exert such an effect when the salt is administered by mouth, that is, when it has to pass through the stomach before it reaches the intestines. The duodenal tube, however, apparently has reached an efficient practical stage. I make, therefore, the suggestion to test in jaundice and biliary colic the local application of a 25 per cent. solution of $MgSO_4$ by means of the duodenal tube. It may relax the sphincter of the common duct and permit the ejection of bile and perhaps even the removal of a calculus of moderate size wedged in the

* Read before the New York Surgical Society, February 9, 1921.

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duct in front of the papilla of Vater. Twenty-five cubic centimetres of the solution as a dose for an adult will bring no harm. For babies the dose should not exceed 4 cubic centimetres. The procedure could be developed into a practical useful method."

To B. B. Vincent Lyon,³ of Philadelphia, belongs the credit of promptly putting to practical use Meltzer's very valuable suggestion. In September, 1919, he published the results of a two-year investigation along the lines suggested by Meltzer and has since added to his large series of cases, reporting them in several articles.^{3, 4, 5, 6} His investigations have dealt with biliary tract cases chiefly, both from diagnostic and therapeutic standpoints. The objection that may be made to the findings in his cases is that relatively few of them were checked by operative or autopsy findings. The technic he has evolved, based upon Meltzer's suggestions, is well thought out and practical. This technic has unquestionably opened up new sources of information in the diagnosis of biliary and pancreatic disease.

The test as suggested by Meltzer and carried out by Lyon presupposes: First, the sphincter action of the muscle of Oddi. Secondly, the Law of Contrary Innervation in the contraction of the gall-bladder with the relaxation of the muscle of Oddi. Thirdly, the specific action of magnesium sulphate in the duodenum in initiating the functioning of this law. So far as the writer has been able to ascertain, the actual experimental demonstration of Meltzer's hypothesis of the Law of Contrary Innervation as applied to the gall-bladder and sphincter of Oddi has not been accomplished. From Meltzer's paper one is led to the conclusion that his discussion was a philosophical one, and he does not state that he actually demonstrated the contraction of the gall-bladder with the relaxation of the sphincter. Lyon does not state that this has been proved by experiment.

Considerable doubt as to the validity of this hypothesis is expressed by Crohn,⁷ of the Mt. Sinai Hospital. He has tested the hypothesis experimentally in eight dogs by making a celiotomy, injecting methylene blue into the gall-bladder and applying $MgSO_4$ solution to the mucosa of the opened duodenum. In only one of the eight animals did he note any contraction of the gall-bladder with a discharge of methylene-blue colored bile from the papilla. That the papilla is relaxed as a result of $MgSO_4$ solution resulting in an increased flow of bile as stated by Lyon and many other clinical observers, has been corroborated in the series of cases here reported. McWhorter,⁸ of Chicago, has recently published experimental proof of this effect of $MgSO_4$ solution in reducing the resistance of the sphincter. In twenty-five dogs he found the average resistance of the sphincter of Oddi to be between 120 and 200 mm. of water. Application of a 25 per cent. $MgSO_4$ solution reduced the resistance from 50 to 100 mm. of water. He states that it produced a transient but not a complete or total relaxation. Unfortunately he makes no mention of whether or not there was a synchronous contraction of the gall-bladder.

In the series here recorded the test has been applied to biliary cases

in which the gall-bladders were so diseased as to preclude any normal emptying due to contraction of the musculature of the gall-bladder wall. The writer, therefore, holds no brief for or against Meltzer's hypothesis in the normal individual. But in this series, where the common duct was not obstructed, MgSO_4 solution instilled into the duodenum caused an accelerated flow of bile. That the bile thus obtained lends itself to bacteriological study would seem to be a valid surmise, and an organism thus obtained, in pure culture, might well be considered an etiological factor in the diseased biliary tract. The studies of Nichols, Simmons and Stimmel,⁹ and of Henes¹⁰ in duodenal cultures of typhoid carriers have conclusively proved the advantages of the duodenal tube in studying the bacteriology of the bile as an indication for surgical therapy.

In reading Lyon's first paper, the writer was impressed, not by the claims made for the method as a therapeutic measure, but by the opportunity the method offered in surgical cases to study the bacteriology of the biliary tract and chemistry of the pancreatic enzymes in the duodenal tube contents before operation, these findings to be checked by the operative findings in the bile, gall-bladder and common duct, gall-bladder tissue, and the pancreas. With this in mind, the writer began to use duodenal intubation in all his biliary cases before operation. Many of the early cases were excluded from this series, because of faulty technic. For this reason the series is small and the facts presented are analyzed for the purpose of stimulating interest in a subject that may prove of real value with cumulative evidence of other investigators.

In forty patients duodenal intubation was accomplished. In eight cases the tube failed to reach the duodenum. The effect of MgSO_4 instillation can be compared with the operative findings in intubations performed in twenty-five cases. In twenty-six patients the pre-operative pancreatic ferment tests can be compared with the condition of the pancreas as determined by palpation at time of operation. In twenty-five cases the pre-operative cultures of the duodenal contents can be compared with the cultures of gall-bladder or common-duct bile or gall-bladder tissue. It may be stated that the pathology of the gall-bladder, the ducts, the pancreas, liver and lymph-nodes was more meticulously observed and recorded than in the average case. Every effort was made to rule out error by sending the specimens of duodenal contents and of bile and gall-bladder tissue to the laboratory as soon as possible and with as aseptic technic as we could devise. The following is the procedure in use at present:

The duodenal tube and tip is of the Einhorn type and has given the best results of several others tried. The technic of preparing the tube and feeding it to the patient is in general that of MacNeal and Chace.¹¹ We are using salol instead of shellac for coating the capsule. The tube is boiled, the tip is covered with a gelatin capsule sterilized in alcohol and then coated with salol, and is given to the patient in the prone position, ten

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to twelve hours after the last meal. The salol is not dissolved until the tip passes into the duodenum. Until an alkaline, bile-covered fluid is obtained by suction with a Luer syringe, the bulb is not considered to be in the duodenum. After this type of fluid is collected in a sterile test-tube and marked "D" or "Duodenal," twenty cubic centimetres of a sterile 30 per cent. $MgSO_4$ solution is injected through the tube into the duodenum. After the darker green viscid "B" or gall-bladder bile begins to drip rapidly from the tube, a specimen is collected in another sterile test-tube and marked "B." After the flow has resumed a lighter yellow a third specimen or hepatic bile is collected and marked "C." The tube is then drawn into the stomach and a specimen is saved to be tested for acidity, free and combined.

"DUODENAL BUCKET" TBST

Salol coated gelatin capsule not used
Hot sterile broth not given
Tube swallowed without difficulty at
First return at
Duodenal contents at

Reaction

Color

Analysis of gastric return:

Appearance
Total acidity
Guaiac
Microscopic

Free HCl
Lactic acid

Ante Op.

Post Op.

Duod. Contents (D); G. Bl Contents (B); Liver Bile (C); G Bl Bile GB; Wall no marked effect from $MgSO_4$

	D	B	C
Appearance:			
Color.....			
Turbidity.....			
Viscosity.....			
Rate.....			
Amount.....			
Reaction.....			
Gritty particles.....			
Microscopic:			
Cholesterin cryst.			
Pus.....			
Bacteriology:			
Aërobic culture.....			
Anaërobic.....			

Pancreatic ferments:

1. Amylase
2. Protease
3. Lipase

Digestion (none, weak, moderate, full)

The three bile specimens are sent to the Bacteriological Laboratory and from there to the Chemical Laboratory. The findings are recorded on the accompanying chart which was devised by Dr. M. Melicow of the present House Staff of the Presbyterian Hospital. Unless there is a systematic recording of positive and negative findings, the notes in the cases are

sure to be deficient when summarized. The findings in these cases may be grouped under the following headings:

1. Bacteriological.
2. Chemical.
3. The Comparison of the Results of $MgSO_4$ Instillation with the Lesion found at Operation.

Bacteriological Findings.—Before stating the results in this series it is of interest to note that before the invention of the duodenal tube several investigators had studied the bacterial content of the duodenum. As early as 1886, Escherich¹² found that in the fasting state or when only intestinal juices were present, the upper intestine in children was practically sterile. Cushing and Livingood¹³ corroborated these findings in their investigations in humans at time of operation and in animals. Hess¹⁴ in 1912 studied fifteen infants by means of the duodenal tube and found colon bacillus in the fasting duodenum of only one child. He suggested the use of the duodenal tube in studying the duodenal flora of adults. In 1913, MacNeal and Chace¹¹ reported their duodenal tube study of the fasting duodenal contents of twenty-four adults from the bacteriological standpoint. Their technic was painstaking and their bacteriological study, both qualitative and quantitative, was elaborate. Their conclusions were:

1. It is possible, with proper care, to obtain a sample of the intestinal juice through the Einhorn duodenal tube sufficiently free from contamination for bacteriological study.
2. The normal duodenal fluid during a fast is almost free from living microorganisms, although numerous bacterial cells are always visible on microscopic examination. The few living microbes obtained in cultures from such fluids are generally Gram-positive cocci.
3. In various gastrointestinal disturbances the number of cultivable microbes in the duodenal fluid is markedly increased. These organisms are of several different varieties, bacilli, cocci, yeasts and branching thread forms being represented in different cases.
4. In the one case of typhoid fever examined, *B. typhosus* was isolated from the duodenal fluid.
5. The bacteriological study of intestinal juice obtained in this way would seem worth while in cases of achylia gastrica with diarrhoea and in cholecystitis. It also seems to us to be a promising field for investigation in those obscure diseases, the causation of which is sometimes ascribed to abnormal intestinal digestion.
6. It may also, perhaps, prove to be a procedure of value in the early diagnosis of typhoid fever and in the detection of typhoid carriers. We think it should be given a trial in this disease, as suggested by the previous work of Hess.

In August, 1920, Einhorn and Meyer¹⁵ published a report on eighteen cases studied at the Lenox Hill Hospital pre-operatively by the duodenal tube. In this series $MgSO_4$ instillation was not done through the duodenal tube, cultures were not made of the pre-operative bile for comparison with cultures of bile and gall-bladder tissue taken at operation. In one of the eighteen cases *B. coli* was recovered in the bile from the excised gall-bladder, in two the bile was reported sterile.

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In the study of MacNeal and Chace,¹¹ the cases were very largely of the gastroduodenal type and only one case of cholelithiasis or biliary duct disease was cultured. None of the cases in the writer's series, except one, showed any evidence of duodenal ulcer. All showed some lesion or other of the biliary tract. Obviously the bacteriological findings in duodenal contents of fasting patients giving a history and physical signs of a biliary tract lesion are of more interest if checked by the cultures of the bile, gall-bladder tissue and gall-stones. But it is necessary to bear in mind the sources of error in the technic and existing conditions of such a bacteriological investigation. The duodenal bile may be contaminated by mouth organisms carried down in the efforts to swallow the tube. The salol coated capsule covering the bulb eliminates a great deal of the contamination, but not entirely. The necessary handling of the gall-bladder in the operative procedure may conform rigidly to surgical asepsis, but not necessarily to bacteriological asepsis. The use of freshly flamed instruments and a seared surface in excising gall-bladder tissue from the specimen conforms to the requirements of tissue culture. Delays in delivering the specimens to the bacteriologist have been guarded against in this series, but in some cases this error has resulted probably in sterile cultures.

A study of the analysis chart (Chart I) will show that the above sources of error, our efforts to eliminate them notwithstanding, have vitiated the comparison of preoperative and operative cultures in many of the cases. Thus there are conflicting findings in about half of the cases. These are not necessarily due to errors in technic however.

It is interesting to note that in about fifty per cent. of the cases one or more varieties of bacteria found in the preoperative duodenal bile were present in the gall-bladder bile or gall-bladder tissue. In some of these, however, contaminations are suggested by the variety of or type of organism.

The presence of *B. subtilis*, *streptococcus salivarius* and *micrococcus catarrhalis* or other mouth saprophytes may be regarded as contaminations in the duodenal cultures. On the other hand the colon bacillus, the hæmolytic streptococcus and staphylococcus aureus, especially if found in the bile following $MgSO_4$ instillation, may be considered as etiological factors and as probably present in the gall-bladder or common duct, or both if "B" bile is obtained. It is the writer's impression from a study of these cases, as well as some one hundred and fifty cases in which gall-bladder bile and tissue from gall-bladder was cultured, that the colon bacillus is the most persistent of the bacteria found in the common duct. In three cases the colon bacillus has been recovered in pure culture from the common duct of cholecystectomized patients four months, one year, and six years after operation. In these patients *B. coli* was cultured from the gall-bladder or common duct bile at time of operation. Rehfus and Lyon have noted this type of persistent infection and advise autogenous vaccine therapy. In this type of case, and after any severe cholangitis relieved by hepatic drainage, the writer agrees with Lyon that duodenal $MgSO_4$ instillation

CHART I
Bacteriology in 25 Cases

History No.	Patient	Sex	Culture of		Lesions found at operation		Culture of gall-bladder tissue	Culture of gall-bladder bile	Culture of common duct bile
			Duodenal bile	"B" or gall-bladder bile	"C" or common duct bile				
47011	E. S.	F	Non-hemolytic strep. B. coli communis Staph. pyogenes aureus	None obtained	Non-hemolytic strep. B. coli communis Staph. aureus	Gall-bladder tense, cystic duct closed. Many faceted stones. Gall-bladder adherent to colon and duodenum. Pancreas not pathological on palpation.	Non-hemolytic strep. B. coli communis, staph. aureus B. fecalis alkalig.	Non-hemolytic strep. B. coli communis, staph. aureus B. fecalis alkalig.	
46382	E. M.	M	No growth	None obtained	Staph. albus	Gall-bladder thick, adherent to duodenum. Contained many calculi and mucoid material. Pancreas felt normal.	Staph. albus	Tube broken	
46666	H. W.	F	B. proteus	B. proteus	B. proteus	Gall-bladder chronically inflamed, adherent to duodenum.	B. proteus	B. proteus	
46813	J. K.	M	Streptococcus	Streptococcus	Streptococcus	No calculi found. Cystic duct patent. Pancreas felt normal.	.....	Non-hemolytic strep.	
46813	J. K.	M	Non-hemolytic strep. or enterococcus	None obtained	Staph. aureus	Gall-bladder showed marked thickening, full of calculi. Common duct dilated.	Non-hemolytic strep. or enterococcus	B. coli	
46813	J. K.	M	B. coli communis	.....	B. subtilis	No stones found in common duct. Pancreas not enlarged.	B. coli		
46732	B. B.	M	Enterococcus, B. coli	None obtained (Specimens obtained 1 month after operation)	Enterococcus, B. coli	Duodenal tube passed 1 month after operation because of symptoms of chronic pancreatitis, although jaundice had entirely cleared and biliary fistula had closed.		No growth	
46823	A. H.	F	Staph. aureus	MgSO ₄ not used	.....	Gall-bladder chronically inflamed, contained many calculi. Cystic duct closed. Pancreas nodular, enlarged. Patient is a diabetic.		No growth	
46318	A. L.	M	Staph. albus	No "B" bile obtained	Rate accelerated, staph. albus	Gall-bladder tense, contained many calculi. Cystic duct closed.	Non-hemolytic strep.	B. coli communis	
45660	K. R.	F	No growth	None obtained	Rate accelerated. No growth	Gall-bladder chronically inflamed, adherent to duodenum. Cystic duct closed. Many calculi in gall-bladder. Head of pancreas nodular.	No growth	No growth	
45660	K. R.	F	B. subtilis	Slow change from yellow to dark green bile	B. subtilis	Gall-bladder. Head of pancreas nodular.	Sterile	B. coli communis	
45289	M. I.	F	B. coli communis	None obtained	B. coli communis	Gall-bladder chronically inflamed. Emptied slowly. No calculi found.			
45289	M. I.	F	Non-hemolytic strep., Gram positive bacillus	None obtained (cholecystectomy)	Non-hemolytic strep.	Cystic duct patent. Pancreas not pathological.	No growth	No growth	No growth
45690	K. K.	F	Staph. albus, Gram neg. spore-bearing bacillus	None obtained	Non-hemolytic strep., gram positive bacillus	Gall-bladder thickened, contained many stones. Cystic duct closed. Pancreas enlarged, nodular at head.	Specimens were placed in incubator in which temperature rose too high for culture of bacteria.		
45690	K. K.	F	Staph. albus, Gram neg. spore-bearing bacillus	No MgSO ₄ used	Non-hemolytic strep., gram positive bacillus	Duodenal tube passed for pancreatic ferments 3 weeks after operation because the developed diabetes.	Gram positive spore bearing bacillus	No growth	
45690	K. K.	F	Staph. albus, Gram neg. spore-bearing bacillus	No MgSO ₄ used	Non-hemolytic strep., gram positive bacillus	Gall-bladder chronically inflamed, contained calculi. Cystic duct patent.		No growth	

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	M. M.	F	No growth	MgSO ₄ not used	No growth	Chronic cholecystitis with calculi in gall-bladder	No growth	No growth	No growth
47248	M. M.	F	B. fecalis alkal.	No "B" bile obtained	No growth	Chronic cholecystitis with many calculi in gall-bladder. Cystic duct closed. Pancreas felt normal.	Gram positive bacilli	Gram positive bacilli	
47177	M. M.	F	No growth	No "B" bile	B. subtilis	Chronic cholecystitis. Shrunk gall-bladder containing gall-stones. Cystic duct closed.	No growth	No growth	
47346	W. S.	F	No growth	No "B" bile	B. coli communis	Intrahepatic gall-bladder, fistula between gall-bladder and colon. Calculus in common duct. Chronic cholangitis. Head of pancreas thickened, hard.	B. coli communis	B. coli communis	B. coli communis
47188	L. G.	M	B. coli communis	No "B" bile	No growth	Gall-bladder adherent to duodenum, contained many calculi. Pancreas large, hard throughout.	No growth	No growth	No growth
47203	A. W.	F	Non-hemolytic strep.	No "B" bile	Non-hemolytic strep.	Acute cholecystitis. Cystic duct closed by edema. Two calculi in gall-bladder.	Non-hemolytic strep.	Non-hemolytic strep.	Non-hemolytic strep.
47414	J. H.	M	Non-hemolytic strep., staphylococcus	No "B" bile	Staphylococcus	Mucus fistula of gall-bladder. Cystic duct closed. (Cholecystostomy 2 mos. previously in another hospital).	No growth	No growth	No growth
47543	A. L.	F	Non-hemolytic strep., staph. albus	No "B" bile	Strep. viridans staph. albus	Recurrent cholecystitis, five years after cholecystostomy. Gall-bladder densely adherent to colon, duodenum and anterior abdominal wall. No stones.	Staph. albus	Staph. albus	Staph. albus
47544	M. H.	F	No growth	No "B" bile	No growth	Congenital absence of gall-bladder. Common duct was obstructed by stones. Pancreas thickened at head.	No growth	No growth	No growth
48279	M. H.	F	Staph. albus. Gram + bacillus	No bile in alkaline contents. No response to MgSO ₄ . Pancreatic firm	No growth	Operation for common duct reconstruction following stenosis of common duct with complete obstruction.	Gall-bladder has been removed	Gall-bladder has been removed	No growth
47689	F. E.	F	Non-hemolytic strep. microc. catarrhalis, staph. albus. Gram + bacillus	No bile in the fluid containing symes. No response to MgSO ₄ instillation	alkaline duodenal g. pancreatic response to MgSO ₄	Gall-bladder was contracted but not inflamed. Pancreas felt normal. Carcinoma of hepatic ducts causing complete obstruction.	No bile found in gall-bladder	No bile found in gall-bladder	Gram positive bacillus <i>Strep.</i>
44186	J. A.	M	B. coli communis	No bile present in which were alk.	duodenal contents line, white, viscous	Acute cholecystitis, empyema of gall-bladder with calculi. Cystic duct closed. Pancreas not palpated.	Enterococcus or non-hemolytic strep.	Enterococcus or non-hemolytic strep.	
48570	F. D.	F	Non-hemolytic strep. or enterococcus	No "B" bile	Non-hemolytic strep. or enterococcus	Gall-bladder was contracted about many calculi. Cystic duct was closed. Pancreas was not pathological on palpation.	No growth	No growth	No growth
38214	C. E.	F	No growth	No "B" bile	No growth	Gall-bladder distended with many calculi. Cystic duct patent. Many calculi in common duct. Liver cirrhotic. Pancreas not enlarged.	Non-hemolytic strep.	Non-hemolytic strep.	Gall-stone in common duct cultured, non-hemolytic strep.
48773	A. G.	F	Non-hemolytic strep.	No "B" bile	Non-hemolytic strep.	Gall-bladder full of calculi. Cystic duct closed. Carcinoma of pylorus	B. coli, non-hemolytic strep.	B. coli, non-hemolytic strep.	B. coli, non-hemolytic strep.
48593	J. K.	..	B. coli communis Enterococcus or non-hemolytic strep.	No "B" bile	B. coli communis Enterococcus or non-hemolytic strep.				

CHART II
Pancreatic Ferment Determinations in 26 Cases

Case No.	Initials	Sex	Amylase	Protease	Lipase	Lesion in pancreas	
47011	E. S.	P	Full digestion	Weak digestion	Weak digestion	Pancreas felt normal	Patient is a diabetic. Second duodenal intubation was done 6 weeks after operation
46813	J. K.	M	No digestion	No digestion	Weak digestion	Pancreas felt normal	
46813	J. K.	M	No digestion	Full digestion	Weak digestion	Developed symptoms of chronic pancreatitis after operation	
46732	P. B.	M	Good digestion	Very weak digestion	Q. N. S.	Pancreas nodular, enlarged	
46732	P. B.	M	No digestion	No digestion	Weak digestion	Urine showed sugar before coming to hospital but was sugar-free at time of operation	
46823	A. H.	P	Good digestion	Good digestion	Good digestion	Head of pancreas indurated	
41764	F. P.	P	Good digestion	Very weak digestion	Not determined	Head of pancreas hard, enlarged	
45289	M. I.	P	No digestion	Good digestion	Good digestion	Head of pancreas large, nodular. Glycosuria after operation	
45690	K. K.	P	No digestion	No digestion	No digestion	Head of pancreas hard, nodular	
47346	W. S.	P	No digestion	Very weak digestion	Weak digestion	Pancreas felt normal	
47188	L. G.	M	Good digestion	Good digestion	Very weak digestion	Head of pancreas hard, enlarged	
47203	A. W.	P	Good digestion	Good digestion	No digestion	Entire pancreas enlarged, hard, oedematous	
47414	J. H.	M	Good digestion	Good digestion	Weak digestion	Pancreas felt normal	
47544	M. H.	P	Good digestion	Fair digestion	Good digestion	Pancreas slightly indurated at the head	
47248	M. M.	P	No digestion	Good digestion	Weak digestion	Pancreas felt normal	
47177	M. M.	P	Good digestion	Fair digestion	No digestion	Pancreas felt normal	
47532	A. L.	P	Good digestion	Good digestion	Good digestion	Pancreas hard, thickened at the head	He came in for observation because of recurring symptoms of chronic pancreatitis
48279	M. H.	P	Weak digestion	Weak digestion	Weak digestion	Three years previously a cirrhotic pancreas had been found at operation	
37542	F. G.	M					
48773	A. G.	P	Fair digestion	Full digestion	Good digestion	Pancreas not pathological on palpation	She came in for treatment for diabetes which had developed since her operation
38214	C. B.	P	No digestion	Full digestion	Good digestion	Pancreas not pathological on palpation	
48593	J. K.	M	Full digestion	Full digestion	Full digestion	Two years previously cholecystectomy, she then showed no thickened or enlarged pancreas	
39040	J. H.	P	Full digestion	Full digestion	Full digestion		
48570	E. D.	P	Full digestion	Full digestion	Fair digestion	Pancreas not made out enlarged	Patient came in with symptoms of an acute exacerbation which subsided. Cholecystectomy and choledochostomy 18 mos. previously
47689	F. E.	P	Fair digestion	Full digestion	Weak digestion	Pancreas felt normal	
39265	M. C.	P	Fair digestion	Fair digestion	Poor digestion	Pancreatitis case 18 months previously. Has symptoms of chronic pancreatitis now	

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should be given at intervals after closure of the biliary fistula until the bile is free from the infecting organism.

Tests for Pancreatic Ferments.—(Chart II). It has been definitely demonstrated in this series that the material to be examined must be analyzed as promptly as possible. The specimens are useless if allowed to stand at room temperature for over an hour.

The technic used has been:

For Amylase: Place 5 c.c. of a 1 per cent. solution of starch in each of six test-tubes. Employ one tube as control.

Tubes	1	2	3	4	5	6
Juice	0	0.05	0.1	0.25	0.5	1.0

Incubate for thirty minutes at 37° Centigrade, then add two drops of decinormal iodine. Violet color disappears in digested tubes.

For Protease: Place 5 c.c. of 0.1 per cent. casein in 0.1 per cent. sodium carbonate solution in each of six tubes. Use same amounts of juice as above. Incubate for fifteen minutes at 37° Centigrade. Add same amount of dilute acetic acid to each tube. Precipitate appears in undigested tubes.

For Lipase: Place 1 c.c. of juice in each of two tubes. Boil one as a control. Add 1 c.c. of neutral ethyl butyrate and 10 c.c. of distilled water plus 1 c.c. of toluene. Incubate for twenty-four hours. Shake several times during the interval. Titrate with N/20 sodium hydroxide, using phenolphthalein as indicator.

Complete absence of all pancreatic ferments in an alkaline duodenal fluid containing bile is fairly definite proof of carcinoma of the pancreas. When bile is also absent in the duodenal contents common duct obstruction is definite.

The interpretation of decreased activity in any one or more of the three enzymes is difficult. If lipase is deficient, this finding should be taken seriously only if the stools show a high total fat content. Deficient pancreatic ferments in the duodenal contents, if proper technic has been followed, may indicate a chronic pancreatitis or advanced pancreatic lymphangitis in a case giving definite gall-stone or cholecystitis history.

The gross changes as noted at operation by palpation are not necessarily an indication of functional disturbance of the pancreas. That is, a pancreas may show marked lymphangitis without appreciable alteration in the pancreatic enzymes. This is fairly well illustrated in the comparison of operative findings with chemical findings in Chart II.

Comparison of the Results of MgSO₄ Instillation with the Lesions Found at Operation.—(Chart III). Taken with the history and physical signs, the duodenal tube findings bid fair to be of real service in localizing the lesion and determining the pathology before operation.

If, after MgSO₄ instillation there occurs a rapid flow of thick, dark green bile, the cystic duct may be considered patent and the walls of the gall-bladder contractile.

If this bile contains much mucus and numerous epithelial cells and leucocytes and intracellular bacteria, but few cholesterol crystals, a chronic cholecystitis without stones is the probable lesion.

CHART III
Comparison of Pre-operative Duodenal Findings With Lesion Found at Operation

			Duodenal bile	"B" or gall-bladder bile	"C" or common duct bile	
47011	E. S.	P	Pale green, slow drip	No dark green bile. No "B" bile	Very turbid, steady flow. Greenish yellow	Cystic duct closed. Gall-bladder distended, adherent to colon. Many calculi
46382	E. M.	M	Pale green, clear	No "B" bile	Yellow, slightly turbid, steady flow	Cystic duct closed. Gall-bladder full of calculi and adherent to duodenum
46666	H. W.	P	Clear golden, thin	Marked change to thick greenish black, turbid	Greenish black to golden brown	Chronic cholecystitis, no calculi, cystic duct patent. Bile thick, blackish green
46732	P. B.	M	Greenish yellow, slow drip	No "B" bile	Greenish yellow, more rapid than before, MgSO ₄	Test was made 6 weeks after cholecystectomy for purpose of testing pancreatic ferments
46823	A. H.	F	Yellowish, slow drip	No "B" bile	Yellowish, rapid flow	Gall-bladder distended. Cystic duct closed by small stones. Gall-bladder bile dark green
46318	A. L.	M	Clear, greenish, slow drip	No "B" bile	Clear greenish yellow, rapid flow	Gall-bladder thickened, adherent to duodenum. Cystic duct closed by calculi in gall-bladder
45660	K. R.	P	Yellow, slow drip	Gradual change to greenish black thick bile	Greenish bile, steady flow	Gall-bladder walls thickened, no calculi, cystic duct patent. Bile dark green, viscid
45289	M. F.	P	Yellow, slow drip	No "B" bile	Yellowish green, steady flow, turbid	Chronic cholecystitis, calculi in gall-bladder and cystic duct. Gall-bladder walls thick, adherent to duodenum
45289	M. I.	F	Yellow, slow drip	No "B" bile	Yellowish, slow	Test made 3 weeks after cholecystectomy
47340	W. S.	P	Yellow, slow	No "B" bile	Yellowish, turbid	Gall-bladder shrunken, around several gall-stones, cystic duct closed
47188	L. G.	M	Greenish-yellow, turbid	No "B" bile	Greenish yellow, turbid	Fistula between gall-bladder and colon, incomplete obstruction of common duct with feces and stone
47203	A. W.	F	Lemon yellow, turbid, slow	No "B" bile	Lemon yellow, more rapid rate	Gall-bladder thick, adherent to duodenum, contained calculi. Pancreas very large. Common duct obstructed with calculi
47414	J. H.	M	Lemon yellow, steady drip	No "B" bile	Lemon yellow, steady drip	Recent acute cholecystitis. Walls and cystic duct oedematous. Cystic duct closed by oedema. Two calculi
47544	M. H.	F	Yellow, clear colorless, alkaline fluid	No "B" bile	Yellow clear, steady flow	Thickened gall-bladder, adherent to colon, duodenum and anterior abdominal wall. Cholecystostomy 6 years previously
44186	J. A.	M	No bile in duodenum	No "B" bile	No response to MgSO ₄	Complete obstruction of common hepatic duct, result of carcinoma of function of right and left hepatic ducts
46813	J. K.	M	Pale yellow, very little fluid in alkaline duodenal	No "B" bile	Pale yellow fluid same as in before MgSO ₄	Chronic cholecystitis with calculi. Cystic duct closed. Common duct dilated, but no stones found
46813	J. K.	M	Golden yellow, steady drip	No "B" bile	Golden yellow after MgSO ₄	Duodenal intubation 1 month after cholecystectomy
47177	M. M.	F	Golden yellow, clear, intermittent	No "B" bile	Clear yellow. Same as before MgSO ₄	Gall-bladder thickened, adherent to pylorus, containing calculi. Cystic duct closed by calculus
47543	A. L.	F	Yellow, turbid, intermittent	No "B" bile	Yellow, turbid, no marked increase with MgSO ₄	Cholecystostomy 2 months previously. Cystic duct closed
48279	M. H.	F	Colorless, alkaline fluid containing pancreatic enzymes	No "B" bile	No effect with MgSO ₄ . No bile obtained	Congenital absence of gall-bladder. Common duct obstructed by 3 large calculi
47689	F. E.	P	Colorless, alkaline fluid containing pancreatic enzymes	No "B" bile	No effect with MgSO ₄	Stricture of common duct below stump of cystic duct causing complete obstruction
37542	F. G.	M	Golden yellow, slightly flocculent	Very abrupt change to thick greenish black bile after MgSO ₄	Return to golden brown, 10' after MgSO ₄	Exploratory 3 years previously showed normal gall-bladder with a cirrhotic pancreas. No symptoms of cholecystitis at present. Intubation was done to test pancreatic ferments
39040	J. H.	P	Golden yellow, turbid	No "B" bile	No change after MgSO ₄	Cholecystostomy 18 months previously. Patient diabetic still shows B. coli in bile culture from duodenum. Gall-bladder bile and tissue showed B. coli at operation
48570	E. D.	F	Golden yellow, clear viscid, alk. steady drip	No "B" bile	Golden yellow, clear, viscid alk. rapid flow	Acute cholecystitis with empyema, cystic duct closed. Calculi in gall-bladder. Pancreas not felt
48593	J. K.	M	Dark amber, turbid viscid, alk. slow drip	No "B" bile. No green bile	Steady flow of brownish yellow, viscid, turbid	Gall-bladder filled with small stones, very little bile. Cystic duct closed by calculi
38214	C. B.	F	Golden yellow, clear viscid, alk. intermittent drip	No "B" bile	Golden yellow, clear, very viscid, intermittent flow	Gall-bladder filled with calculi and grayish mucus. Cystic duct blocked by a calculus, pancreas not enlarged
48773	A. G.	P	Light green, turbid, viscid, gritty particles present	Rush of darker green bile after MgSO ₄ . May have been "B"	Golden yellow, clear, viscid alk. rapid flow	Gall-bladder filled with large and small stones. Cystic duct patent. Common duct contained 15-20 calculi

DIAGNOSTIC USE OF DUODENAL TUBE

If, in addition to the last mentioned findings, cholesterol crystals microscopically are numerous and the bile feels gritty, calculi are also present.

If there is no "B" bile, but there is a history of biliary colic with marked tenderness in the gall-bladder region with or without palpable mass, the cystic duct is closed as a result of calculus or the oedema of an acute or subsiding cholecystitis.

"If there is no "B" bile, but the bile following $MgSO_4$ instillation contains many intracellular bacteria and leucocytes, an infection of the common duct as well as cholecystitis may be diagnosed.

If in a jaundiced case there is no bile in the duodenal contents showing pancreatic ferments, common duct obstruction above the papilla is surely present.

The duodenal tube is not an essential factor in the diagnosis of biliary and pancreatic cases, but it is fair to say that it gives information that permits of a more detailed and accurate diagnosis. The method can by no means take the place of a careful history analysis or thorough physical examination. All three should be considered in the diagnosis of this class of patients.

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ACUTE INTESTINAL OBSTRUCTION DUE TO STRANGULATION OF A LOOP OF SMALL INTESTINE BY MECKEL'S DIVERTICULUM

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MECKEL'S Diverticulum is a congenital anomaly caused by a persistence of the protruded portion of the small gut which is known as the intraabdominal portion of the vitelline duct and which is normally obliterated during the seventh week of fetal life. The vitelline duct connects the gut with the yolk sac at an early period of embryological development. It assumes most commonly the form of a finger-like protrusion ending, as a rule, blindly, from the terminal ileum, usually about one metre from the ileocecal junction. It most often springs from a point opposite the mesenteric border and generally has a smaller lumen than the adjacent coils of ileum. It is of fairly common occurrence, being found in about 2 per cent. of all subjects. Since the process of obliteration may be arrested at any stage, it naturally follows that there may be all degrees from the most frequently observed shallow pouch of one or two centimetres in depth, to the patent diverticulum which preserves its connection with the umbilicus and from which a small amount of mucus exudes, mixed at times with watery fecal material and constituting a persistent umbilical fistula.

A common variety is seen as a protrusion about the size and shape of a glove finger and possessing a rudimentary mesentery. Sometimes its distal portion is dilated so that it assumes a bulbous appearance.

There is usually a persistence of all the coats normally found in the small intestine and histologically the mucosa resembles that of the ileum.

There are a number of pathological conditions in which the diverticulum of Meckel becomes involved, although, considering its incidence in 1 per cent. of all subjects, it is not commonly the seat of trouble. Perhaps inflammatory processes are among the most frequent, and diverticulitis is attended by a symptomatology that renders its differentiation from appendicitis extremely difficult.

Intestinal obstruction due to Meckel's Diverticulum may be produced in several different ways:

(1) Volvulus may take place by rotation of the ileum about its mesenteric border caused by the lever action of the distended diverticulum.

(2) Intussusception has occurred due to the invagination of an inverted diverticulum into the ileum forming the starting-point for a progressing intussusception.



FIG. 1.—Loop of small intestine strangulated beneath a Meckel's Diverticulum.



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(3) The commonest form of obstruction is caused by the diverticulum assuming the rôle of a band and causing strangulation of bowel loops caught between it and its attachment to the intestine and to the abdominal wall, generally at or near the umbilicus, or more rarely to the posterior parietal peritoneum near the root of the mesentery.

As the obstruction grows more acute the diverticulum as well as the obstructed coils of gut become gangrenous and perforation may occur.

REPORT OF A PERSONAL CASE.—E. P., male, aged twenty-six years, was admitted to the Mary McClellan Hospital of Cambridge, N. Y., on June 6, 1920. He was brought to the hospital by Dr. Charles H. Holmes, of Buskirk, at 7 P.M., with the following history:

The patient was a farmer, had always enjoyed excellent health; no previous abdominal symptoms. On Sunday, the day of admission, he had a good breakfast; shortly afterward he began to feel slight nausea and discomfort in the epigastrium. He stated he felt as if his abdomen had been struck. He went about doing his ordinary work after breakfast. One hour later began to have severe paroxysmal pains low down in the abdomen, which he characterized as "doubling-up" pains. These pains recurred at short intervals of a few minutes. The paroxysms continued to grow worse. He vomited for the first time one and one-half hours after his breakfast, and twice in addition, before operation. The bowels had not moved in the morning of the onset, and he had been somewhat constipated the night before. He stated that he had climbed inside of a chimney the day before; he had no fall and made no misstep, but was very much exhausted by the effort.

Previous History.—No similar previous attacks. Had had occasional vomiting attacks with pain after riding over rough roads. No history of indigestion. He does not remember any previous illness.

Physical Examination (on admission to the hospital).—Well-built young adult, apparently about twenty-five years of age, suffering from frequent attacks of paroxysmal abdominal pains, localized in no particular spot, centring, roughly speaking, about the umbilicus; slight tenderness in the right iliac fossa and region of McBurney's point, but no rigidity of the rectus muscle. Rectal examination negative; no mass palpable in any portion of the abdomen; no localized distention of coils of intestine in any portion of the abdomen. Heart and lungs, negative.

A provisional diagnosis of acute appendicitis had been made before he entered the hospital.

When I first saw him at 8 P.M. Sunday evening, eleven hours after the onset of his symptoms, physical examination showed the conditions just described; temperature, 98.6°; pulse, 72 (rectal temperature taken showed 99.2°). Blood examination: Whites, 12,400; polys, 90 per cent.; large lymphocytes, 2.5 per cent.; small lymphocytes, 7.5 per cent.

While we were unable to make a definite diagnosis of the condition, we felt certain that the very severe, steadily increasing paroxysmal pains

and particularly the general appearance of the patient—which was that of a person suffering from severe shock—made immediate exploration not only desirable but imperative. The patient was accordingly taken to the operating room and Doctor Coley operated upon him as soon as possible, with the assistance of Dr. Stanley T. Fortuine, the resident surgeon. A vertical incision of the right rectus was made under ether anaesthesia. There was a large amount of clear fluid in the peritoneal cavity. At first nothing but deeply congested, distended coils of small intestine could be found. The appendix was normal. After careful search a loop of small intestine about one and one-half to two feet in length was found, greatly distended and dark in color, but not gangrenous, located in the bottom of the abdomen, somewhat more to the right side than to the left, a little above the pelvis. This loop of bowel was found to be strangulated by what seemed to be another loop of intestine, firmly attached and connected with a loop of small intestine above. The constriction was so tight that it was absolutely impossible to withdraw or free the strangulated loop. It took some time to recognize the exact anatomical condition, but it soon became apparent that we were dealing with a Meckel's Diverticulum, nearly of the same calibre as the normal small intestine, coming off at right angles from the lower portion of the ileum, about two feet from the ileocecal valve and extending downward to the root of the mesentery, and attached so firmly that it required a great deal of manipulation to dissect it off without tearing it. When the distal end was finally freed the strangulated loop slowly regained its color and, under hot towels, became apparently viable. The diverticulum was about five inches in length, had a rudimentary mesentery and tapered slightly in its distal end. It was of a deep, dark-red color, almost gangrenous in appearance, due to the great pressure of the distended coil beneath it, which was less dark than the diverticulum itself. The diverticulum was clamped off close to the wall of the intestine from which it had sprung, and the opening into the intestine, which was about one and one-half inches in diameter, was closed with two rows of fine chromic gut suture; the abdominal wound was closed without drainage.

The patient made an uninterrupted recovery, and has been in good health up to the present time.

Discussion.—Reginald Fitz's classical paper, "Acute Intestinal Obstruction," read before the Congress of American Physicians and Surgeons, in Washington, in September, 1888, represents the most complete discussion of the subject that had thus far appeared. It contained a critical analysis of 295 cases collected from the surgical literature, with careful elimination of all cases in which full data were lacking. These 295 cases are classified as follows: Strangulation, 101 cases; intussusception, 93 cases; abnormal contents, 44 cases; twists and knots, 42 cases; strictures and tumors, 15 cases.

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Of the 101 cases of strangulation 63 were due to adhesions, 21 to vitelline remains, 6 to adherent appendix, 6 to mesenteric and omental slits and 3 to peritoneal pouches and openings, 1 to adherent tube and 1 to pedunculated tumor.

Seventy per cent. of the obstructions from strangulation occurred in males.

In 82 per cent. of all the cases of strangulation, pain was the first and most important symptom, usually sudden, severe and colicky, and most frequently starting in the region of the umbilicus. In 69 per cent. of the cases nausea and vomiting were associated with the pain.

Tympanitic distention of the abdomen occurred in slightly over half of the cases, most often after the first to the sixth day.

Slight rise of temperature, usually below 100° F., was noted in about one-half of the cases.

The position of the strangulating object was found in the right iliac fossa in 67 per cent. of the cases, and in the lower abdomen in 83 per cent.

In the cases treated medically death occurred in half of the cases from the second to the fourth days.

Fitz's paper brings out in a striking manner the great difference between the methods of treatment of intestinal obstruction in 1888 and the present time.

Operation was performed in 67 per cent. of the cases of strangulation, with 41 deaths, or a mortality of 61 per cent.

Of the 67 cases operated upon with 41 deaths, it is interesting to note that operation was performed on or after the third day in 39 of the cases, and in 32 on or after the fifth day. In other words, in 1888, early treatment of acute intestinal obstruction was practically always medical; in fact, Fitz himself states:

"In the light of the published experience of the past eight years, the medical treatment of acute obstruction is limited to the use of injections during the first three days, under sufficient degrees of pressure, within fixed limits, to determine the patency of the large intestine. If it proves impassable, the case is no longer medical, but surgical." In conclusion, Fitz states, "Acute intestinal obstruction is diagnosticated by exclusion, the seat is fixed by injection. Its variety is determined by its seat, the age, antecedents and symptoms of the patient. Its treatment is surgical on or after the third day, if the symptoms are urgent and forced injections fail to relieve."

In strangulation by Meckel's Diverticulum I believe the most important diagnostic symptom is severe, colicky pain with frequently recurring paroxysms, non-localized, nausea and vomiting; complete absence of stools, and absence of tenderness and rigidity. Next in importance to the pain is the general appearance of the patient, which is more or less that of a person suffering from shock.

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CASES OF STRANGULATION FROM MECKEL'S DIVERTICULUM REPORTED IN RECENT LITERATURE

CASES I-II.—JAMES E. THOMPSON reported two cases of intestinal obstruction due to Meckel's Diverticulum before the meeting of the Southern Surgical Association in St. Louis in 1897. Case I was an acute strangulation of the ileum under a bridge formed by Meckel's Diverticulum, the symptoms lasting five days; operation; death. The patient was a young man twenty-nine years of age who, when first seen by Doctor Thompson, had been suffering from severe symptoms of intestinal obstruction for five days. The attack began with very severe abdominal pain. He had been treated by repeated doses of strong purgatives and enematas, without success. Temperature, 99°; pulse, 72; moderate distention. Immediate operation was advised, but refused until the following day. A loop of small intestine was found strangulated by a band in the right iliac fossa; this band proved to be a short, stumpy Meckel's Diverticulum, one and one-half inches long. The distention was so great that some of the coils had to be emptied of gas before the intestine could be replaced. The patient died of shock a few hours later.

The second case, while classed by Doctor Thompson as a case of intestinal obstruction due to Meckel's Diverticulum, is really a case of strangulated inguinal hernia, which had been reduced by prolonged taxis on the part of the patient himself. The taxis caused a rupture at the root of Meckel's Diverticulum, resulting in peritonitis, for which the operation was done at a late stage without avail. Hence, this case can hardly be classed as an obstruction due to strangulation by a Meckel's Diverticulum.

CASE III.—E. W. SYMPSON (*Lancet*, June 30, 1917, p. 998). The patient, a youth twenty-one years of age, was admitted to the Lincoln County Hospital on May 1, 1917, suffering from acute intestinal obstruction. Acute peritonitis two years previously. Two days before admission to the hospital he had an attack of sudden, acute pain over the whole abdomen, spasmodic in type and followed by persistent vomiting, which, within twelve hours, became definitely stercoraceous; there had been absolute constipation from the start. Temperature, 97°; pulse, 130; feeble. Provisional diagnosis of "strangulation by bands" was made. On operation a Meckel's Diverticulum was found about two feet above the ileocecal valve; it was about four inches long, adherent at its tip to the posterior abdominal wall and to the root of the mesentery opposite the second lumbar vertebra, and forming an aperture through which about two feet of ileum had become prolapsed and strangulated. The patient made an uninterrupted recovery and was discharged four weeks after operation.

CASE IV.—ROSCOE GRAHAM, in the *Journal of the Canadian Medical Association*, vol. 8, p. 966, November, 1918, reports four cases of intestinal obstruction due to Meckel's Diverticulum, three of which were operated upon by Dr. F. N. G. Starr.

The patient, a woman, married, aged forty-five years, was admitted to the Toronto General Hospital complaining of severe pain in the right iliac region, which had come on suddenly eight days before, and lasted for three days, accompanied by considerable vomiting. She had had more or less discomfort in this region ever since her first child was born, sixteen years ago. After the third day the pains became less severe, but left a dull soreness. Examination showed a temperature of 102°; pulse, 100; slight muscular rigidity on the right side and tenderness on palpation. Operation: evacuation of appendicular abscess and removal of organ. After doing well for three days, the patient became steadily worse, and the probable diagnosis of paralytic ileus was made; further operating was considered inadvisable. The patient died a week after operation.

Post-mortem examination showed, eighteen inches from the ileocecal valve, a volvulus of the ileum, produced by Meckel's Diverticulum, which had caused almost complete obstruction.

CASE V.—The second case, a female, was admitted to the Toronto General Hospital on October 9, 1916 (Dr. F. N. G. Starr). She complained of pelvic pains which had existed for the past two years. Abdominal examination showed nothing abnormal.

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Vaginal examination revealed a cervical polyp and marked retroversion. Operation October 10th. Removal of polyp and appendix; correction of retroversion. Uneventful progress for first ten days; then pulse became more rapid and nausea set in. There was great distention. The pulse-rate reached 120. After further examination, a tentative diagnosis of obstruction of small intestine was made. On operation coils of the small intestine were found collapsed, and on following them up it was seen that they herniated under a Meckel's Diverticulum which was attached to the convex border of the ileum and to the superior aspect of its mesentery. The obstruction was relieved and the diverticulum amputated. The patient died twenty-four hours after operation.

CASE VI.—The third case, a woman, was admitted to the Toronto General Hospital on November 31, 1916, to the service of Doctor Starr. She complained of abdominal swelling, which she had noticed for the past few months and which was accompanied by vomiting and obstinate constipation. The appendix had been removed two years previously, and she has a ventral hernia. After examination the diagnosis of ovarian cyst was made and operation advised. It was found that the cyst arose from between the layers of the left broad ligament. On separating the adhesions, a mass of adherent intestine was found, from which ran a diverticulum which was attached to the cyst wall. It was deemed best to resect the bowel and an end-to-end anastomosis was made. Uninterrupted recovery.

CASE VII.—The fourth case, a boy, fourteen years of age, was admitted to the Toronto General Hospital (Doctor Starr) on December 3, 1915, complaining of abdominal pains. He had had two previous attacks, but the symptoms always disappeared after a few hours. This time they persisted. After careful examination, the tentative diagnosis of internal hernia was suggested, possibly caused by a Meckel's Diverticulum, despite the fact that the case clinically simulated appendicitis.

On operation a hernia was found under a Meckel's Diverticulum, very much the same as in the preceding case, except that a small loop of bowel was herniated, the rest having reduced itself spontaneously.

CASE VIII.—HABHEGGER (*Interstate Medical Journal*, September, 1916) publishes a case of intestinal obstruction due to Meckel's Diverticulum in a girl, eight years of age. She was taken sick on November 26, 1917, with severe abdominal pains, which recurred intermittently and were followed by vomiting, first, of mucous bile, later dark-brownish material; no bowel movements; no flatus. Examination, ten hours after the onset of the attack, showed the patient to be evidently desperately ill. Temperature, normal; pulse, soft and irregular; blood-pressure, 40. Facial expression natural. Abdomen uniformly distended; diffuse tenderness over the entire lower part of the abdomen; tympany everywhere; no muscular rigidity. The diagnosis of intestinal obstruction and paralytic ileus considered, but the clinical picture of collapse, apathy and stupor did not fit either condition. Operation was, of course, indicated, but not feasible for obvious reasons. The child grew progressively worse and all attempts to relieve the bowel were futile. She died twenty-three hours after the onset of the attack with all symptoms of collapse due to intense intoxication.

Autopsy revealed a large mass of reddish, bluish-black small intestine, greatly distended and filling the whole abdominal cavity; large intestine normal. No fluid in peritoneal cavity. Further examination of the small intestine showed it strangulated by a round band, which encircled the base of the mass of discolored bowel. The intestine involved was the jejunum at its junction of duodenum and ileum, within a few feet of the cæcum. The band was four inches in length and attached to ileum, about two feet above the ileocecal valve, and on its other extremity to the root of the mesentery of the jejunum near the spine. Through this opening, about four inches in diameter, about twelve feet of small intestine had prolapsed. Practically the entire small intestine was involved.

CASE IX.—R. A. BENNETT in *The Lancet* of June, 1919, publishes a case of intestinal obstruction due to Meckel's Diverticulum, in a girl, thirteen years of age. She was

admitted to the Torbay Hospital, Torquay, on November 21, 1918 (Dr. A. Spong) with a history of sudden abdominal pain, setting in four days previously, after a hearty meal. The pain was not intense nor localized. Vomiting soon followed and the patient had been more or less sick ever since. No bowel movement since the onset of the attack; no flatus. Temperature, 98.6° F.; pulse, 128; respiration, 24. The whole abdomen was rigid and tender, the pain being most pronounced on the left side, just above the umbilicus. A diagnosis of intestinal obstruction was made and the abdomen was opened at once. Distended, acutely congested small bowel presented, and when pushed aside revealed collapsed small intestine and colon. After further search, Meckel's Diverticulum was found; its proximal portion was a thin and fibrous cord, twisted many times on its axis; the distal part was a dilated pouch, filled with blood-clots and adherent to a tag from great omentum, also inflamed and twisted. The connection had formed an arch under which the lower four feet of ileum had become partially strangulated.

HOHLBECK (*Arch. f. klin. Chir.*, Bd. lxi, p. 1, 1900) reports three cases of intestinal occlusion due to Meckel's Diverticulum, observed at the City Hosp. of Riga (Dr. von Bergmann), with two deaths and one cure.

CASE X.—A young man, aged eighteen years; 29/7/94. There was an ileocecal invagination, about one-half foot in length. Drawn into the invagination there was a Meckel's Diverticulum the size of a walnut, which had undergone such changes as to render extirpation necessary. The diverticulum was not inverted *in toto*, but only its mucous lining.

July 7: No stool; no gases. Patient died in collapse the following day.

CASE XI.—Boy, aged four and one-half years. May 5, 1898: Diverticulum about six inches in length, situated 22 cm. above ileocecal valve and adherent with its blind end to an omental band. Resection of 27 cm. of small intestine together with diverticulum. Murphy's button. The diagnosis of occlusion due to Meckel's Diverticulum in this case was made only after examination in narcosis, when a tumor, the size of a small finger, was palpated to the right, below the umbilicus, the torsion of the intestine around its longitudinal axis resulting from the pull of the adherent diverticulum causing the occlusion.

CASE XII.—Woman, aged thirty-nine years; October 16, 19—. About 40 cm. above cæcum a loop of ileum is seen to be constricted by a band; further down, this is connected with a diverticulum 23 cm. long, of the shape of a cucumber, about 4 cm. at its upper end. The walls of the diverticulum are expanded to the maximum. Resection of a piece of intestine 80 cm. in length. Murphy's button with Lembert suture on top. Patient discharged cured November 10th.

Diverticulum incarcerations, according to Leichtenstern, are much more frequent in men than in women, his statistics, comprising 66 cases, showing 52 males and 14 females.

The prognosis of incarceration due to Meckel's Diverticulum is very bad. Boldt collected 55 cases with 15 laparotomies and only 3 cures; mortality of 80 per cent.

Bérard and Delore collected 32 cases of laparotomy for occlusion due to Meckel's Diverticulum, with 9 cures and 23 deaths—72 per cent. mortality.

Hohlbeck states that Kelyack's opinion, holding Meckel's Diverticulum to be a harmless formation, certainly seems remarkable. He found a Meckel's Diverticulum 18 times in 1446 cadavers, and in none of these was the cause of death in any way related to the diverticulum.

I believe that the mortality of acute intestinal obstruction from Meckel's Diverticulum should be greatly reduced if operation is done early, say within the first twelve hours, instead of after two to three days, as has been the case in most of the cases operated upon.

CASE XIII.—FERGUS (*Glasgow Medical Journal*, 1915, lxxxiv, p. 12). (No dates given.)

The patient, a young woman, aged nineteen years, was evidently acutely ill; temperature up, pulse rapid; obstinate constipation; pain and tenderness all over abdomen,

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spasmodic in character; rigidity of muscles; vomiting; considerable distention. Diagnosis of intestinal obstruction made; operation advised; removed by ambulance to one of the nurses' homes, where she was operated upon by Doctor Dalziel. The small intestine was found intensely congested, of a dull reddish-purple color, and greatly distended. The obstruction was found to be due to a Meckel's Diverticulum, about eight inches in length and of a calibre nearly equal to that of the small intestine. It had firmly strangled the small intestine, the distal end of the diverticulum being bound down by fresh adhesions. The diverticulum was freed, but in view of the congested condition of the small intestine above the obstruction, it was not considered advisable to do more than relieve the obstruction and free the diverticulum, which was returned into the abdomen, and the wound closed. The patient made a good recovery. The diverticulum was removed in a second operation a few months later. She has been in good health since.

CASE XIV.—DRYBROUGH-SMITH (*Lancet*, London, 1917, ii, p. 24). June 30, 1917.

Operation done on an infant, seven days old. The child had a patent Meckel's Diverticulum at birth, protruding from the umbilical cord just beyond its attachment to the skin. The bowel acted through this opening as well as by the natural passage. On the fifth day after birth, the child began to vomit and gradually intestinal obstruction became complete. On opening the abdomen, it was seen that the ileum had invaginated itself into Meckel's Diverticulum, dragging with it the mesentery. Result not stated.

CASE XV.—W. F. PEARCE.—Perforation of Meckel's Diverticulum and accompanying appendicitis (*U. S. Nav. M. Bull.*, Washington, 1919, xiii, p. 346).

Patient male, U. S. N. Res. Corps, brought to the hospital on December 25, 1918. For the last two to three days slight discomfort in abdomen. In the morning of the 25th severe pain in the region of the umbilicus, later shifting to Meckel's Diverticulum; vomited several times. Temperature, 98.6° F.; pulse, 120; pinched expression of face; abdomen very sensitive, particularly over McBurney's point; marked muscular rigidity. Immediate operation. A large amount of greenish-gray fluid encountered. Appendix inflamed, sharply kinked, in beginning gangrene, but not perforated; removed. Further careful search disclosed Meckel's Diverticulum, definitely inflamed and with a perforation about midway between tip and base; removed; stump inverted; two drains placed and incision closed in layers. Eight days after operation, temperature normal and drainage ceased on tenth day. The patient was up and about and wound closed at time of report.

The diverticulum in this case was 4 cm. in length, 2.5 cm. at top and 3 cm. at base.

CASE XVI.—E. A. WILKINS (*Med. Press*, London, 1919, cvii, p. 10). Male, aged twenty-two years; farmer. Sudden onset of severe, colicky pains in umbilical region; moderate vomiting; slight abdominal tenderness; no rigidity, nor distention. Pulse full and strong; temperature normal; face of good color. Intestinal obstruction considered, but thought unlikely. Turpentine enemata gave relief. Not called to see patient again till next day, 11 A.M. Then pains very severe; abdomen full; rigidity; great tenderness. Temperature, 101°; pulse slightly above normal, but strong. No vomiting since. Immediate removal to hospital; operation done two hours later by H. T. Dawson. A large tumor became evident under anaesthesia in mid-abdomen. On incision, black blood ran out and two large coils of black small intestine presented; a constricting band was felt across the root of the coils, which gave way under the finger and was not seen. No normal viscera seen; everything black; very little distention; wound closed. Severe pain, tenderness and rigidity continued for four days, requiring morphine; enemata failed to give relief; no vomiting. Pulse continued good and but little above normal until a day before death.

Post-mortem showed a perforation in the strangulated bowel, which had not recovered. A Meckel's Diverticulum, four inches long, three-fourths inch wide at base and tapering to a point, was found, the end of which was rough and evidently had been adherent. Fully four feet of bowel had been strangulated.

Wilkins says that this case shows that severe strangulation can occur without distressing vomiting and with a good pulse.

HERTZLER and GIBSON, of Kansas City, Mo. (*American Journal of Medical Sciences*, Philadelphia and New York, 1913, cxlvi, p. 364), in addition to reporting a personal case of invagination of Meckel's Diverticulum, associated with intussusception, have made a careful study of the recorded cases, and append brief histories of forty-one cases of invagination of Meckel's Diverticulum, associated with intussusception, in which sufficient data were obtainable to permit a judgment of the anatomical character of the lesion. All other incompletely reported cases are omitted.

In this series the age of the patients varies from 7 months to 39 years, the average being 13 years; 20, or 49 per cent., of the cases were under 10 years of age; 10 between 10 and 20 years.

The sex is given in 38 cases, 31 being males, 7 females.

In 17 of the 41 cases a history of previous attacks is definitely given. In 3 a single attack is mentioned; in 9 repeated attacks. Vomiting was recorded present in 24 cases, and in character was usually dark green or yellowish. The authors state that vomiting, compared to many types of intestinal obstruction, is characterized by its moderate intensity.

Of the cases in which resection was done, in so far as definite information is available, 13 died, and 9 recovered. Five of these cases came to operation from the sixth to the eighth day after the onset of the symptoms, indicating a subacute process. Of those in which reduction was feasible, requiring the removal of the diverticulum only, 9 recovered and 4 died. Their personal case was a youth, nineteen years of age. Two years before, attack of abdominal pains which he ascribed to eating raisins. The attending physician found a tumor immediately below the umbilicus, which he supposed to be a mass of raisins. He manipulated it with his fingers in order to break up the lump. The symptoms subsided and the patient had no trouble until December 18, 1912, when he became chilly and nauseated; better after two days; then, after a hearty breakfast, severe pain, followed by vomiting. The pains increased and morphine was administered; enemas were also given, but the symptoms continued. A tumor was palpated to the right of the median line. At last the patient was brought to the Halsted Hospital, with the diagnosis of intestinal obstruction. Examination showed the abdomen but slightly sensitive; no rigidity; moderate distention. Of course, it must be remembered that morphine had been given. Pulse, 144; temperature, 97°; respiration, 24. On opening the abdomen, straw-colored fluid escaped; the intestinal coils were injected and greatly distended; no paralysis. The ileocecal portion of the intestine was found lying over the kidney, presenting a tumor, which was seen to be an intussusception through the ileocecal valve, about twelve inches long, with a distinct tumor at its upper extremity. This was found to be an inverted Meckel's Diverticulum with a thickened apex about two and one-half inches long. The diverticulum was replaced; the mass in its apex was about the size of a walnut. Diverticulum was clamped just above the solid mass and mattress sutures passed on the ileal side of the clamp; latter removed and gut severed. Inversion of end into lumen of gut; cæcum replaced and loop of ileum containing stump of diverticulum pulled over above and distal to cæcum. During first days there was profuse drainage, which gradually reduced and drains were removed. (No data as to further history.)

As regards the frequency of Meckel's Diverticulum, statistics vary greatly. Its frequency, based upon autopsy reports, is given as 1 to 2 per cent. In 18,000 autopsy examinations of subjects who died of other trouble, fifteen cases of Meckel's Diverticulum were found, making it less than 1 per cent.

The interval of time elapsing between the first symptom and the operation varied between two to eight days. In our own case the interval

STRANGULATION BY MECKEL'S DIVERTICULUM

was less than twelve hours, which is the shortest period of time that we have been able to find in any of the recorded cases.

As regards the age of the patient in the cases which we have been able to collect, the youngest was four and one-half years old, and the oldest forty-five years; six occurred between the ages of fifteen to twenty-five years.

Balfour, in a review of 10,000 successive operations performed at the Mayo Clinic from 1907 to 1910 (*Collected Papers of St. Mary's Hospital*, 1910), reports fifteen cases of Meckel's Diverticulum. Of course, this does not give an accurate idea of the frequency of the anomaly for the reason that in comparatively few cases was there a necessity for a systematic search of the entire intestine. In only five of these cases had the diverticulum given rise to symptoms and only one of the five was operated upon for acute intestinal obstruction due to adhesions about an inflamed diverticulum. One was operated upon for a chronic obstruction of the cæcum and appendix which had slipped through a loop formed by a long, cord-like Meckel's Diverticulum, nine inches in length. In another case the operation was done for a discharging navel in a child two years of age. It was due to a Meckel's Diverticulum in connection with the ileum, and extended to the umbilicus.

The only case which was operated upon for acute obstruction was a male of five years. In this case there was a large diverticulum extending from the ileum to the umbilicus. It was necessary to do a lateral anastomosis between the loops of the ileum above and below the constricting point. Doctor Finney in his recent exhaustive paper on three hundred cases of acute intestinal obstruction observed at the Johns Hopkins Hospital over a long period of years, states that there was not a single case of acute obstruction due to Meckel's Diverticulum.

CHRONIC DUODENAL OBSTRUCTION WITH DUODENO-JEJUNOSTOMY AS A METHOD OF TREATMENT *

REPORT OF FORTY-ONE OPERATIONS

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IN my paper on this subject published in 1918, the belief was stated that the condition is common and that the diagnosis can often be made from the history and physical examination.

The object of this communication is to further emphasize the importance of the condition, to review the literature of the subject, to summarize our present knowledge concerning it, to present in greater detail the technic of duodeno-jejunostomy as a method of treatment and to report a further series of cases in which the procedure has been successful. In order to give a clear conception of the condition I have quoted freely from my previous paper on this topic.

The first record found in the literature is an article in Latin written by Boernerus¹ in 1752, in which he refers to the work of Celsus and Sylvester and describes the symptoms in a case of chronic obstruction.

"The patient was a man somewhat over fifty years of age, who appeared a skeleton. In the left hypochondrium was to be seen an oblong tumor, resisting but soft, easily movable both above and below, extending from the diaphragm down to the pubes. The appetite was nil, and the bowels were persistently obstructed so that it was only after eight days' use of aperients and enemata that a few indurated scybala were brought forth. There was nausea with inclination to vomit, occasionally even vomiting itself.

About eight weeks later he died. On the day following his death an autopsy was made. When the skin and abdominal muscles had been incised and dissected, there was not a trace of the peritoneum, the omentum, or the mesentery discernible. The canal of the intestines was confused chaos. But in the left hypochondrium, from the diaphragm quite to the pubes, was an oblong membranous sac, dilated and filled with flatus, occupying the whole region. It was the stomach dislocated from its proper site, passing below the umbilicus. Proceeding with the search, in the duodenum was found a solid and wrinkled constriction, exceeding the thumb in breadth, and so constricted that it was impossible to force through it even the most dilute fluids. The liver was of normal size but friable. Of the gall-bladder there was no distinct trace—there was marked hardening of the spleen."—Boernerus, *Fredericus, De Tabo sicca lethale*, 1752. Condensed from the translation in full by Dr. J. W. Brannan.

In 1820 Yeats² described toxic symptoms which he attributed to compression of the duodenum by the transverse colon, and noted the close relation between the hepatic flexure and the lower part of the descending duodenum.

In 1829 Guyot³ reported a case of congenital contraction, and was followed by a number of other authors.

* Read before the Bellevue Alumni Society, February 2, 1921.

CHRONIC DUODENAL OBSTRUCTION

The first report appearing in the American literature is that of Anderson⁴ in 1848.

Von Rokitsky, in 1849,⁵ suggested that acute dilatation of the stomach is due to compression of the duodenum by the root of the mesentery.

Fagge⁶ described the symptoms of acute dilatation of the stomach in 1873 and reported the autopsy findings in what was apparently a case of duodenal obstruction with perforation.

In 1889,⁷ Glenard suggested that the traction from dilatation of the stomach causes a narrowing at the duodeno-jejunal boundary. He held that chronic duodenal obstruction is not uncommon.

Albrecht⁸ reported two cases of possible chronic obstruction in 1899, and noted the flattening of the duodenum between the spine and superior mesenteric artery. By attaching small weights to the mesenteric vessels he demonstrated that considerable water pressure is necessary to force fluid through the constricted duodenum.

In 1900, Robinson⁹ reported clinical observations and autopsy findings in cases of duodenal obstruction and showed a clear understanding of the relation it bore to compression by the superior mesenteric vessels. He was convinced that gastroduodenal dilatation is the indirect cause of many deaths in persons above forty years of age. His work is original and was the most comprehensive presentation of the subject up to that date.

In the same year Petit¹⁰ reported a case of acute mesenteric ileus cured by suturing the jejunum to the transverse mesocolon.

In 1905, Ochsner¹¹ described a sphincter muscle in the duodenum below the ampulla of Vater, to the action of which he attributes much of the duodenal pathology.

Boothby¹² (1907) questions the accuracy of his

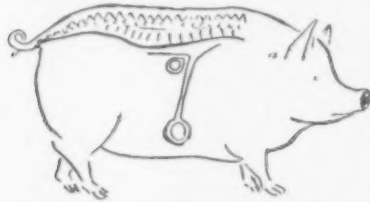


FIG. 1c.—The horizontal animal with ideal digestion. The root of the mesentery does not compress the duodenum.

(Reproduced from Codman's paper with permission of the author.)



FIG. 2.—In vertical woman the duodenum is compressed by the mesenteric root.

observations, believing that the so-called sphincter muscle is merely a thickening of the muscle coat.

In 1905, Zade¹³ discussed post-operative gastromesenteric ileus. He is convinced that dilatation of the stomach is the most important etiological factor. If surgical intervention is necessary, he recommends jejunostomy.

Conner¹⁴ in 1906 reviewed the literature and described the symptoms and pathology of acute dilatation of the stomach and its relation to obstruction of the duodenum. He demonstrated on the cadaver that traction on the mesentery in the direction of axis of pelvis may obstruct the duodenum. He states that the presence of the small intestine in the pelvis seems to be a *sine qua non* to the production of mesenteric occlusion of the duodenum. The mesentery must not be long enough, however, to allow the intestines to rest on the pelvic floor. Of the clinical manifestations of chronic obstruction, he says, nothing is known.

Bloodgood in 1907,¹⁵ and again in 1912,¹⁶ wrote on this topic. He reported cases of chronic obstruction cured by resection of the cæcum and ascending colon.

In 1908, Codman¹⁷ presented a masterly résumé of the subject. It is his contention

that the transverse portion of the duodenum is more or less compressed by the root of the mesentery. Anatomical deviations from the normal or certain pathological conditions may increase this pressure to a varying extent, up to the point of occlusion of the gut. When this pressure reaches a degree great enough to give more resistance to the muscular efforts of the duodenum than the closed pylorus, the condition becomes of pathological

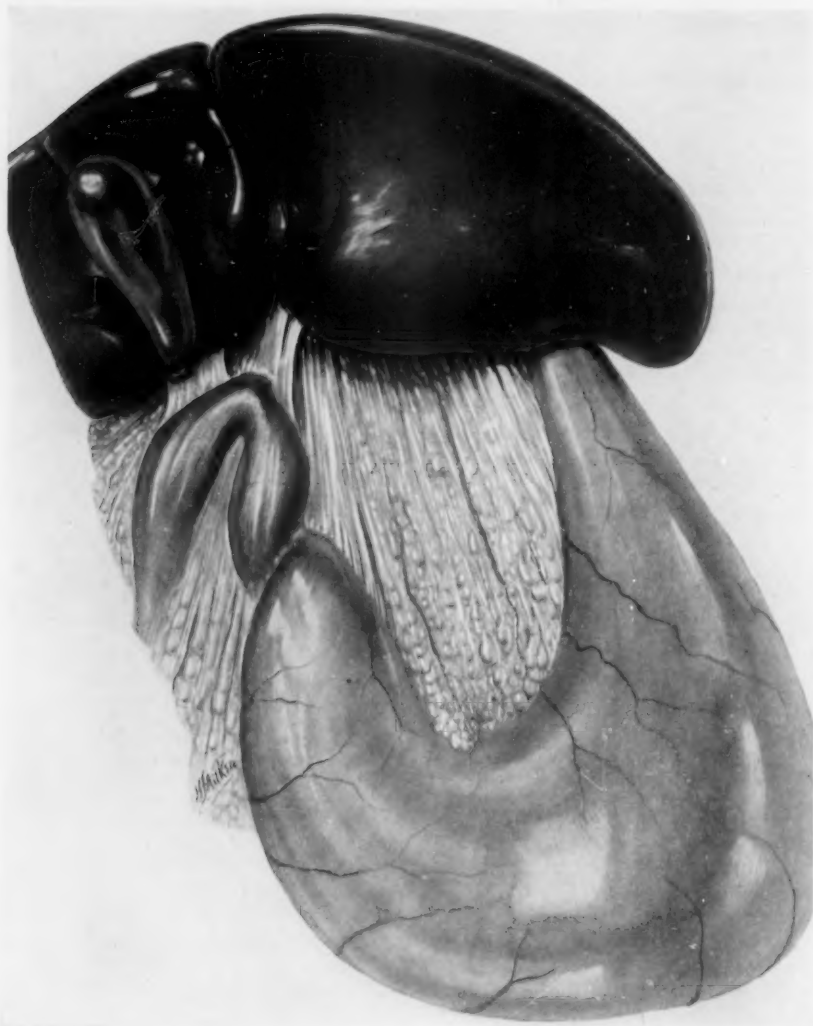


FIG. 3.—Duodenal obstruction at the junction of the first and second portions. Gastropnoxis caused angulation at that point.

significance. The duodenal secretions are thus brought in contact with mucous membranes unfitted physiologically to withstand their corrosive action. Obstruction favors stasis in the duodenum and bacterial invasion of the tissues. Acceptance of the above propositions will alter the present conception of such conditions as hyperchlorhydria, nervous dyspepsia, duodenal and gastric ulcer, pancreatitis, cholelithiasis, persistent vomiting after laparotomy and in pregnancy.

CHRONIC DUODENAL OBSTRUCTION

Laffer²⁸ reviewed the literature of acute gastromesenteric ileus in 1908. The student will find in his bibliography and in that of Conner's the more important articles dealing with acute obstruction. The study of these will add to the understanding of the chronic condition.

Lane,^{19, 20} Spencer and Graham,²¹ Melchior,²² Harris,²³ Benjamin,²⁴ Corwin,²⁵ Barber,²⁶ Vanderhoof²⁷ and Kellogg,^{28, 29} have published papers dealing with the chronic phases of the problem.

During 1920, Freeman,³⁰ Crouse,^{31, 32} and Quain³³ discussed the operative treatment.

Several interesting anatomical studies have been published which add to a better comprehension of the subject. I refer particularly to an article by Sir Frederick Treeves³⁴ in 1885, describing the developmental changes which take place in the primary digestive

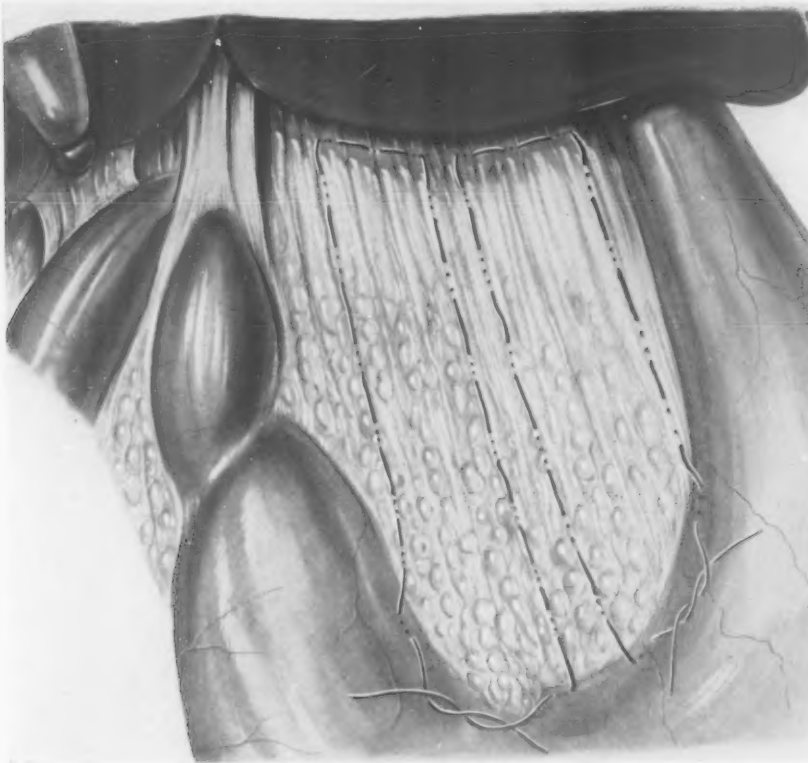


FIG. 4.—Duodenal obstruction due to gastropnoxis. Corrected by taking a reef in the gastrohepatic omentum, (Beyea's operation).

tube, and to that of Lewis Dwight,³⁵ presented in 1897, demonstrating various types of duodenum by the use of wax casts. He recognizes the U, V, ring, C, triangular and S, shapes. His casts show a constriction at the termination of the first, second and third portions, and in the latter a groove posteriorly from vertebral pressure and a notch above where it is crossed by the superior mesenteric vessels.

In 1903, Fawcett and Blatchford³⁶ studied the relation of the lower border of the transverse duodenum to the vertebral column and reported as follows:

Total number of autopsies	337
Male	190
Female	144

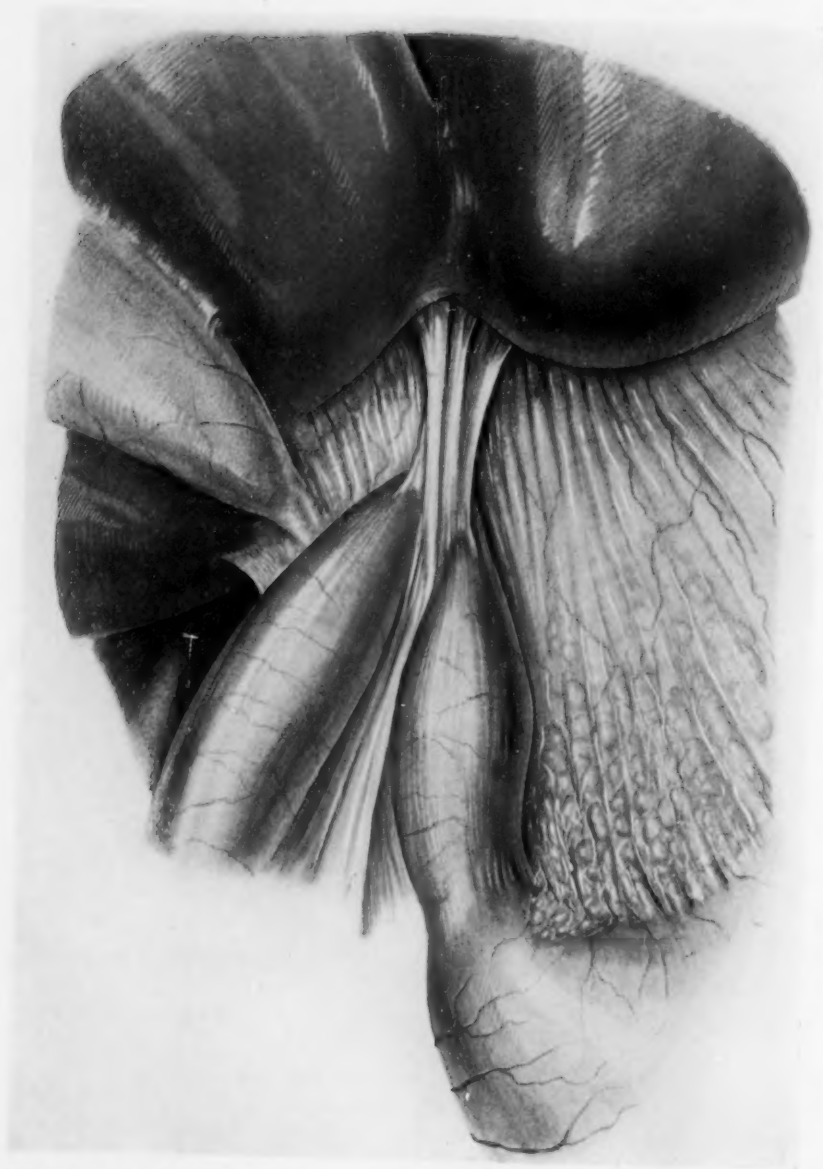


FIG. 5.—Duodenal obstruction at the termination of the first portion caused by a band of adhesions crossing in front and drawing it up under the liver, producing acute angulation. Treatment consisted of dividing adhesions and sliding the duodenum downward so as to correct the angulation.

CHRONIC DUODENAL OBSTRUCTION

Relation of lower border to vertebra:

Second lumbar	30 or 8.9	per cent.
Disk	44 or 10.	per cent.
Third lumbar	162 or 48.	per cent.
Disk	44 or 13.	per cent.
Fourth lumbar	46 or 13.6	per cent.
Disk	4 or 1.8	per cent.
Fifth lumbar	2 or .59	per cent.
Disk	1 or .29	per cent.
Did not cross vertebral column	4 or 1.8	per cent.

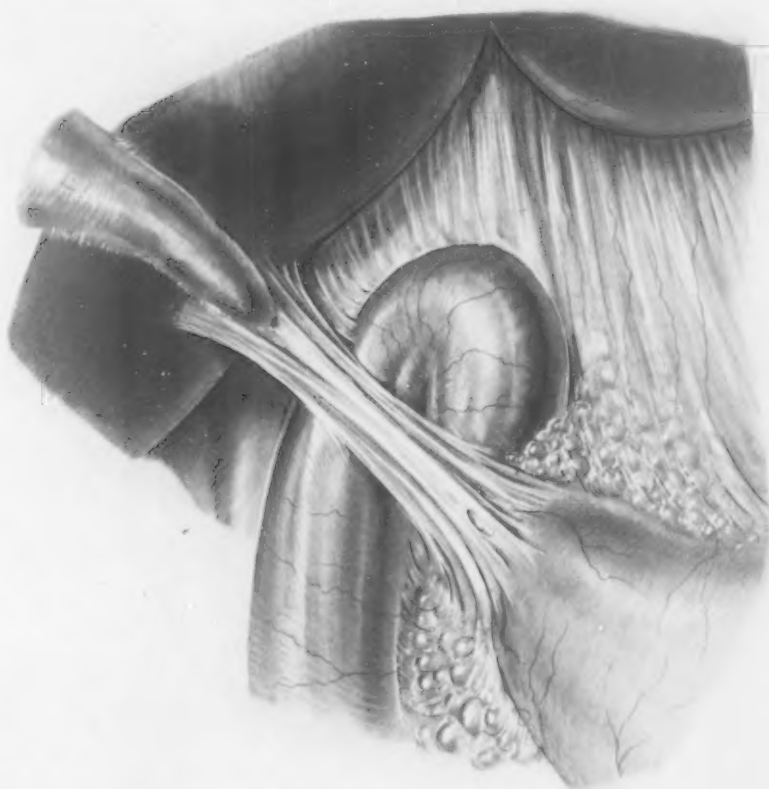


FIG. 6.—Duodenal obstruction above the ampulla of Vater resulting from a healed pyloric ulcer. A heavy band extends from the gall-bladder across the duodenum to the pylorus. The gall-bladder is drawn back to show the constricting band, but at operation it was found to be adherent to the duodenum and pylorus. The treatment consisted of cholecystectomy and dividing adhesions.

Jonnesco,²⁷ 1889, wrote on the topographic anatomy of the duodenum.

Armstrong,²⁸ Freeman²⁹ and Aitken³⁰ have described a type of duodenum having a mesentery passing down to the pelvic brim and ascending to the transverse mesocolon.

MECHANISM OF DUODENAL OBSTRUCTION

In studying the mechanism of duodenal obstruction, the following predisposing causes should be considered. In the developmental changes,

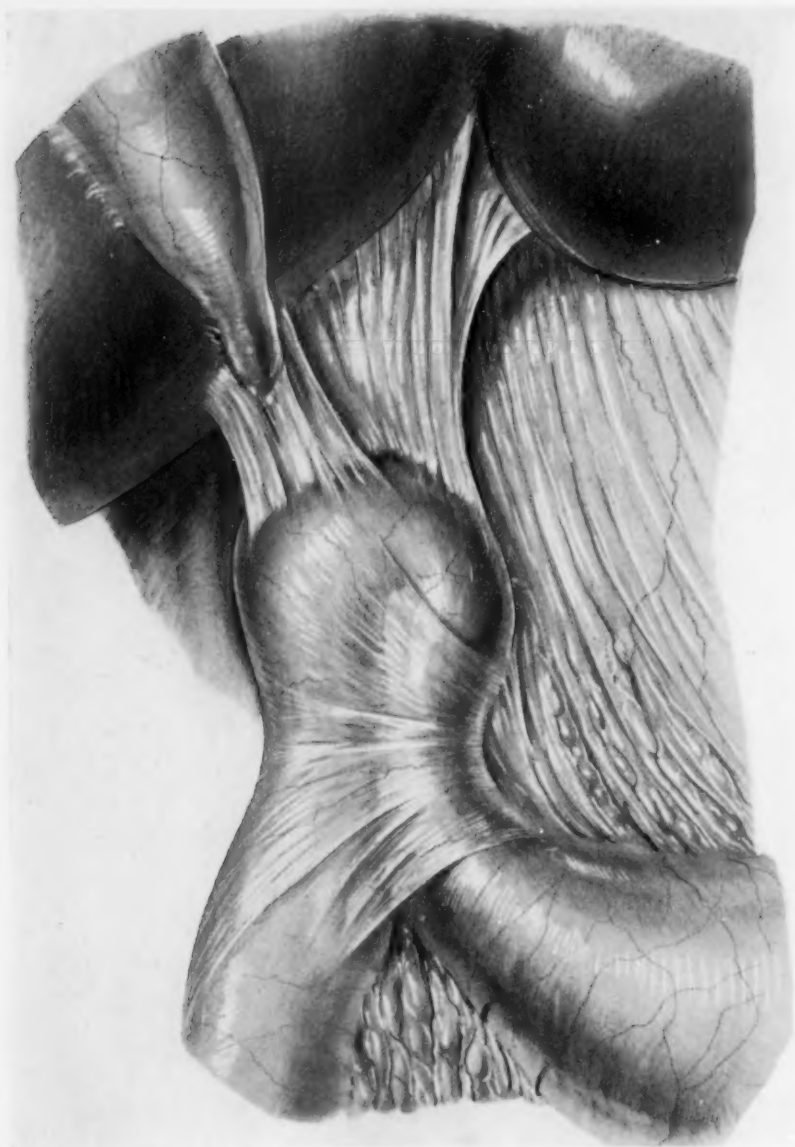


FIG. 7.—Duodenal obstruction involving the first and upper half of second portions, caused by an enveloping membrane. The two portions are held closely approximated. Treatment consisted of duodeno-duodenostomy.

which take place in the primary digestive tube during the process of rotation and the progress of the cæcum to the right iliac fossa, the duodenum is left in a position favoring compression between the vertebral column and the mesenteric root. This congenital disadvantage will be increased by faulty development of the lower thoracic region, lordosis of the lumbar spine, relaxed abdominal walls, a loosely attached cæcum and ascending colon, long mesentery and mesocolon.

CHRONIC DUODENAL OBSTRUCTION

The obstruction may involve (a) the first portion only, (b) the first and second portions, (c) the entire duodenum. (See Figs. 1 to 15.)

When the obstruction is limited to the first portion, it is usual to find one of the following causes: Duodenal ulcer, angulation caused by adhesions between the first and second portions, mesenteric bands drawing the duodenum up under the liver, or gastropptosis, the duodenum remaining fixed.

When the second portion is involved, we find adhesions extending



FIG. 8.—Duodeno-duodenostomy performed for relief of duodenal obstruction caused by extensive adhesions between the first and second portions.

from the gall-bladder or hepatic flexure of colon, adhesions between the second and third portions, or angulation at the junction of the second and third portions caused by the downward drag of a prolapsed hepatic flexure.

In obstruction of the entire duodenum, the direct cause is usually the compression of the duodenum between the vertebral column and the superior mesenteric vessels.

Bloodgood¹⁵ has pointed out that this is favored by a redundant cæcum displaced into the pelvis with a short mesentery at the portion of the ileum near the cæcum, and the writer has called attention to

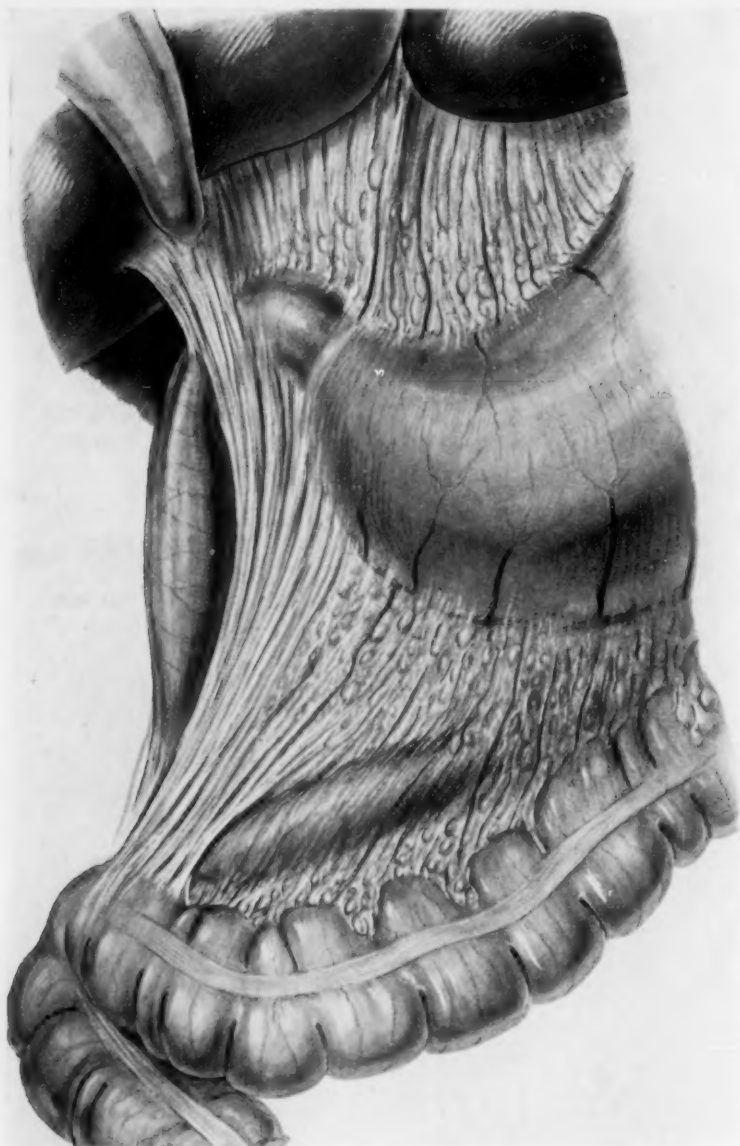


FIG. 9.—Duodenal obstruction at two points. Adhesions extend from the gall-bladder across the termination of the first and second portions of the duodenum to the prolapsed hepatic flexure of the colon. Treatment consisted of dividing adhesions, suturing cecum and ascending colon to posterior peritoneum and restoring the hepatic flexure.

ptosis of the hepatic flexure, permitting a direct pull upon the mesenteric root.

Other causes which have been described are an annular-shaped pancreas surrounding the duodenum, gall-stones impacted in the duodenum, angioma of the jejunum, constriction of mesenteric opening through which the duodenum passes, angulation at the duodeno-jejunal junction,

CHRONIC DUODENAL OBSTRUCTION

gastroptosis, disease of the pancreas, ulcer, cancer, adhesions involving the jejunum, gastroenterostomy and prolonged dorsal decubitus.

The physical signs of obstruction above the ampulla of Vater are those of pyloric obstruction, the stomach being dilated or prolapsed and emptying slowly, sometimes with visible peristalsis.

In obstruction of the second and third portions, as pointed out by Hayes,⁴⁰ the dilated duodenum may be shown by a tympanitic area be-

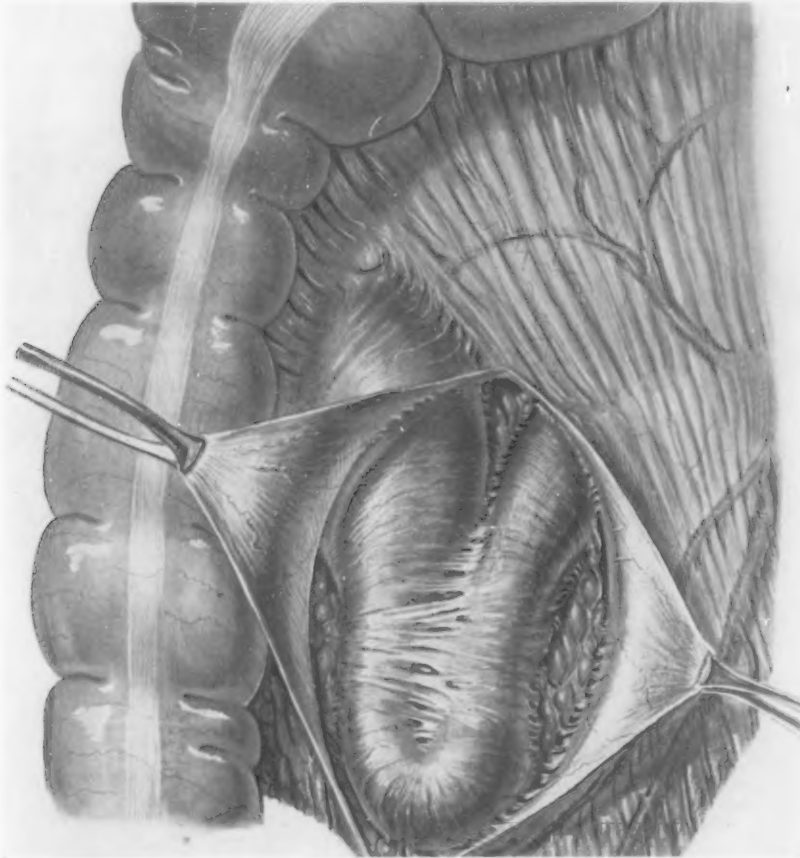


FIG. 10.—Duodenal obstruction due to adhesions between the second and third portions. Treatment consisted of dividing adhesions and duodeno-jejunostomy.

hind the right rectus muscle, to the right of, or posterior to, the pylorus and lying between the liver above and transverse colon below. Percussion should be employed with sufficient pressure to diminish the gastric and colonic tympany. Pressure upward and backward beneath the transverse colon permits the duodenum to empty itself, the gas can be felt or heard escaping into the jejunum, after which the percussion note becomes relatively dull, or there is a marked diminution in the size of the tympanitic area.

Limited experience with the duodenal splashing sound, described by Cash,⁴¹ leads to the belief that it is a physical sign of value.

The X-ray study of obstruction of the first portion commonly makes the diagnosis clear, but in obstruction of the entire duodenum a negative report is not infrequent, partly due to the fact that the predisposing cause may not be constantly operating, or that duodenal peristalsis may have been stimulated by a preliminary cathartic, but also because a special technic is often required. Quimby⁴² states that "by filling the duodenum and pressing upward on the stomach, then rotating the

patient to the left, the amount of retention in the duodenum should show the degree of obstruction."



FIG. 11.—Duodenal obstruction involving the third portion. (This picture is borrowed from Bloodgood's paper⁴³, and is published with permission of the author.)

SYMPTOMS

For a clearer understanding, the cases may be grouped in accordance with the anatomical and symptomatic variations.

Anatomical Grouping.—

First. The asthenic duodenum: The symptoms are latent or toxic. X-ray examinations may show delay and puddling of bismuth in the duodenum, with sluggish peristalsis and slight or no dilatation.

Second. Duodenal obstruction with incompetent pylorus. Bile regurgitates easily into the stomach, dilatation is moderate or absent.

Third. Obstruction with hypertrophy (the writhing duodenum). The duodenum is elongated and its walls are thickened. Under the fluoroscope it is seen to labor over its contents. The pylorus functions and little or no bile regurgitates; cramp-like pains are the predominant symptom.

Fourth. Dilated duodenum. The area of duodenal tympany is increased. Pain is usually present, either steady and dull, or cramp-like. This is the type most frequently recognized by the röntgenologist.

Symptomatic Grouping.—First, latent; second, toxic; third, mechanical; fourth, toxic and mechanical.

CHRONIC DUODENAL OBSTRUCTION

Latent obstruction may exist without diagnostic symptoms, the condition being recognized at operation or by X-ray examination.

THE TOXIC SYMPTOMS

Laboratory studies of duodenal toxicity, after ligation of the jejunum, have been made by Maury,⁴³ McLean and Andries,⁴⁴ Whipple, Stein and Bernheim.⁴⁵ Experimental animals die in a few days with weak pulse, low blood-pressure, subnormal temperature and diminished secretion of urine. The last authors have shown that the cause of death is a chemical and not a bacterial poison.

In human beings we find these symptoms, together with the characteristic vomiting or regurgitation, in acute gastromesenteric ileus, in certain cases of vicious circle after gastro-enterostomy, and in the terminal stages of chronic duodenal obstruction.

The usual toxic symptoms are less severe, however, such as vomiting, headache, neuralgia, mental and physical depression, disturbed heart action, cold extremities, hyperæsthesia, paræsthesia, skin eruptions and neurasthenia.



FIG. 12.—Duodenal obstruction involving the third portion. (Borrowed from Deaver's paper⁶¹ and published with the permission of the author.) This patient had a duodenal ulcer which perforated three times and ultimately caused death.

THE MECHANICAL SYMPTOMS

These vary with the mechanism of the attacks. When obstruction involves the first portion only, the symptoms are those of partial pyloric obstruction. Harris²³ has made a study of this group and states that it is a chronic condition with remissions. His patients complained of distress or pressure in the epigastrium sometimes becoming a sharp pain, recurring two or three hours after meals and relieved by food. With this there is epigastric tenderness and excessive secretion of hydrochloric acid. If compression takes place in the region of the ampulla of Vater, we may have papillary stenosis, as pointed out by Anders⁴⁶ and Campiche,⁴⁷ with deep chronic jaundice, acholic stools,

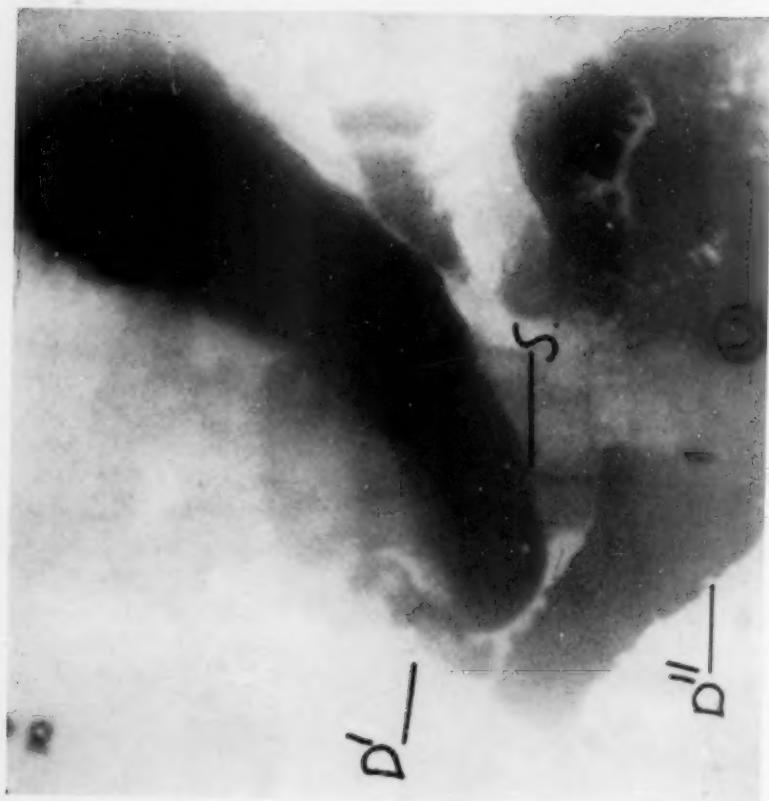


FIG. 13.—Mrs. W. No. 4. Dilatation of entire duodenum cured by duodeno-jejunostomy.

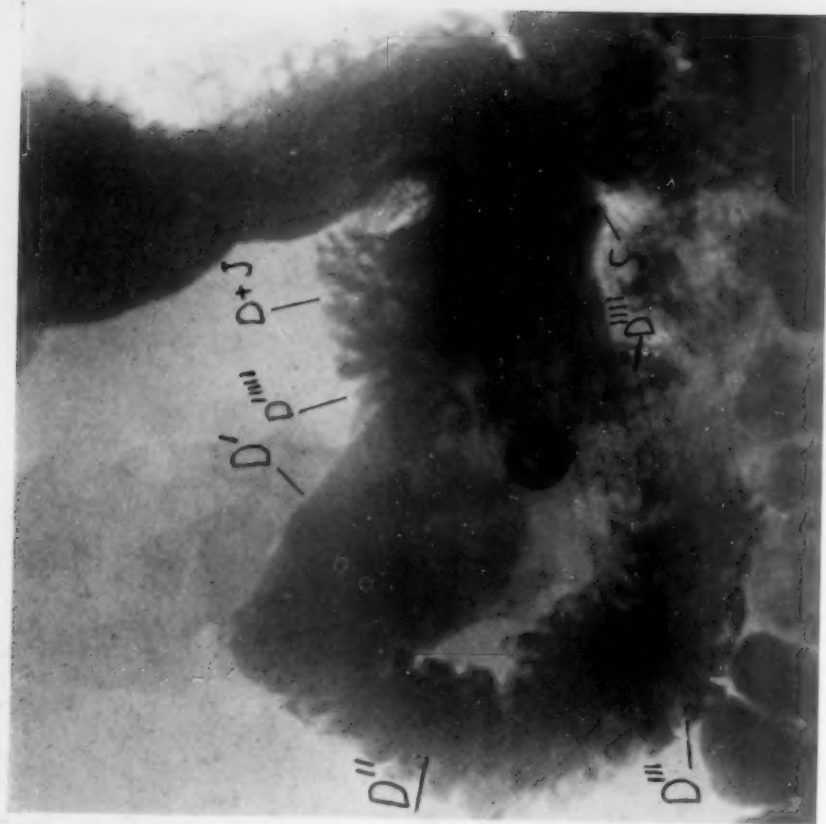


FIG. 14.—Mrs. S. Dilatation of entire duodenum.

CHRONIC DUODENAL OBSTRUCTION

enlarged and sensitive liver. In my experience, this is accompanied with pain referred to the right costal arch.

In all obstructions below the ampulla of Vater the symptoms may be grouped together, except for pain at the duodeno-jejunal junction, which seems to be peculiar to constriction at that point. If due to prolapse of the intestines, there may be periods of comfort when the bowels are functioning properly, but with constipation the drag of the distended bowel inaugurates an attack. This is probably the mechanism of so-called bilious attacks characterized by constipation, headache, and vomiting of bile.

The condition of the pylorus will modify the symptoms, for with a resistant pylorus pain is prominent, while with a relaxed one regurgitation or vomiting of bile occurs without pain. Two areas of discomfort are observed, a pain or dull ache at the left of the median line, slightly higher than the navel (the duodeno-jejunal junction), relieved by deep pressure, and a pain above and at the right of the navel, extending under the liver and to the shoulders. This may be colic-like, due to peristaltic unrest, or steady and dull, due to distention and often lasting until relieved by vomiting. Occasionally, pain is limited to the back and is referred to the midline between the shoulder-blades. It may be of an intense boring character. Following an attack of pain the patient may "feel something give" (apparently the resisting pylorus yielding to pressure), the pain subsides and vomiting or regurgitation of bile follows. Frequently patients obtain relief from deep pressure in the median line of the abdomen below the navel (presumably by unlocking the duodeno-jejunal kink). Attacks of pain may simulate biliary colic or duodenal ulcer or chronic appendicitis, and in operating for these conditions with negative findings, duodenal obstruction should be looked for. In the majority of the cases there will be a combination of both toxic and mechanical symptoms.

In contrast with the above, pain is usually absent in acute gastromesenteric ileus, or if present in the beginning, disappears with the prog-



FIG. 15.—This is a type of duodenum described by Armstrong, Freeman and Aitken. In sixty-four autopsies at Harvard Medical School, five cases were observed in which the duodenum descended to the pelvic brim and ascended with a mesentery to the under surface of the transverse mesocolon. This sketch illustrates how a supposedly short loop posterior gastroenterostomy may really leave a long proximal loop predisposing to vicious circle. (Published with the permission of Mr. Aitken, whose paper will appear in the Boston Medical and Surgical Journal.)

ress of dilatation. This, with the absence of fever, accounts for the frequent failure to diagnose the condition.

TREATMENT

A minority of the cases are surgical from the beginning, notably those having a hugely dilated duodenum, or continuous and copious regurgitation of bile into the stomach.

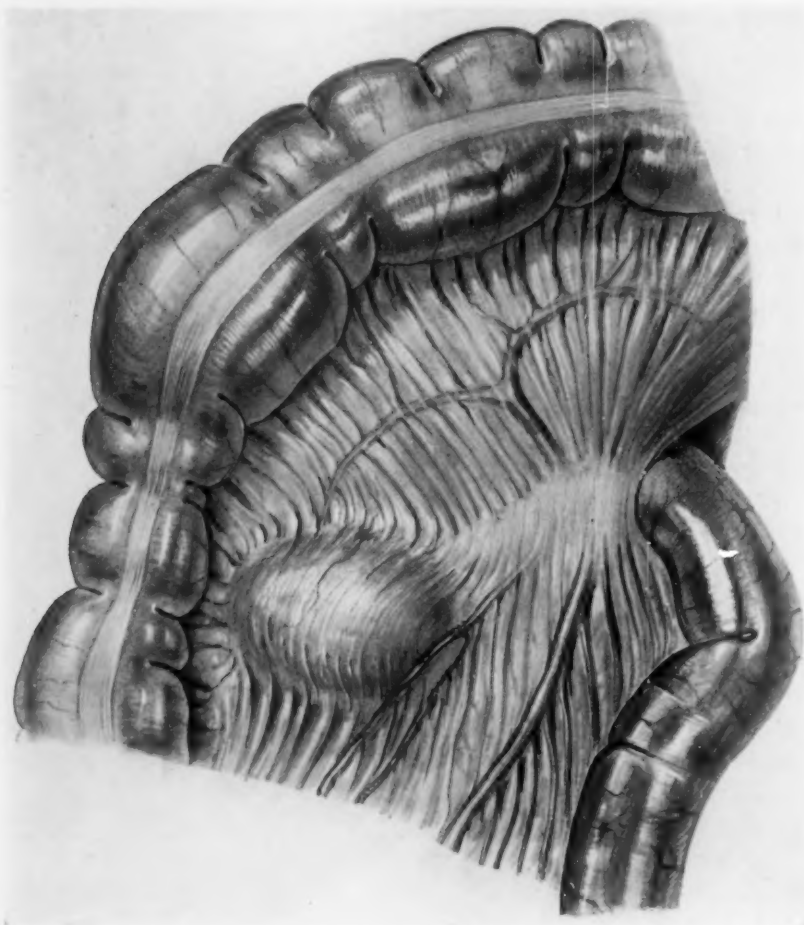


FIG. 16.—Duodeno-jejunostomy. The dilated third portion of the duodenum presents as an oval mass close to hepatic flexure of the colon.

In the greater number, the dilatation is less marked, but they have attacks of pain, or bile regurgitation, or toxic symptoms with intervals of comfort between the attacks, the symptoms often not pointing clearly to the duodenum. For these cases medical treatment should always be tried and it is usually successful. It consists of abdominal support, sleeping with foot of bed elevated, resting after meals, postural treatment,

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abdominal massage and exercises, lavage, duodenal⁴⁸ and colonic irrigations, mineral oil, cathartics, rest cure and overfeeding.⁴⁹

When not successful, surgery is indicated. The procedure may be directed to the duodenum itself, or to some other part, the pathology of which is a factor in producing obstruction, frequently to both. The following operative procedures have been recommended: Jejunostomy, resection of duodenum and reuniting anterior to mesenteric vessels, approximation of recti muscles, gastroenterostomy, suturing the jejunum to under surface of transverse mesocolon, dividing adhesions with readjustment of duodenum, shortening the gastrohepatic omentum (Beyea⁵⁰), enlarging the mesenteric opening, stretching or dividing the ligament of Trietz, cholecyst-gastrostomy, or enterostomy (for papillary stenosis), suspending the transverse colon (Coffey⁵¹), plication and fixation of cæcum and ascending colon, with restoration of hepatic flexure, resection of cæcum and ascending colon, cholecystectomy (to prevent gall-bladder adhesions from reforming), duodeno-jejunostomy.

The choice of procedure will be determined by the subjective symptoms and mechanical conditions. In obstruction of first portion, dividing adhesions, the Beyea or Coffey operations or gastroenterostomy; of the second portion, the same, or cholecystectomy or duodeno-duodenostomy; of the third portion, some procedure to relieve the intestinal drag, Coffey operation, resection or plication and fixation of cæcum and ascending colon, duodeno-jejunostomy.

Duodeno-jejunostomy was suggested by Bloodgood¹⁸ in 1907 and first performed by Staveland²² in 1908. Since then the following cases have been reported:

In 1913, Bartlett²³ used a Murphy Button for duodeno-jejunostomy to relieve vicious circle after gastroenterostomy, and Allen²⁴ operated for traumatic retroperitoneal displacement of the duodenum, first doing a gastroenterostomy and afterwards duodeno-jejunostomy for persistent vomiting and emaciation.

In 1915, Corwin²⁵ reported an operation for giant duodenum and quoted W. J. Mayo, who said he had done the operation in one case with an unsatisfactory result.

In 1915, Beer²⁶ operated for an angioma of jejunum, first excluding the jejunum by a circular suture.

Ernst,²⁷ in 1916, successfully performed an anterior duodeno-jejunostomy on an eleven-day-old child for a congenital stenosis of the duodenum. This is the only report of its kind found in the literature.

Downes²⁸ reported an operation for giant duodenum in 1918, and in a personal communication states that he has performed the operation three times. He refers to a case operated upon by Beckman, of the Mayo Clinic.

In 1920, Collins,²⁹ discussing Freeman's paper, stated that he had performed the operation in one case, Quain³⁰ reported five cases, and Crouse³¹ recommends the procedure, but does not state the number of cases in which it was performed.

The writer,^{28, 32} reported twenty-three cases in 1918, and in this paper a further series of eighteen is added.

With the exception of Ernst's operation in a case of congenital stenosis, no cases are reported in the foreign literature.

Melchior,³³ in 1917, in "Die chirurgie des duodenum," refers to it as a procedure that can be considered in the presence of profound duodenal stenosis, but states that up to the present time gastroenterostomy is almost always performed.

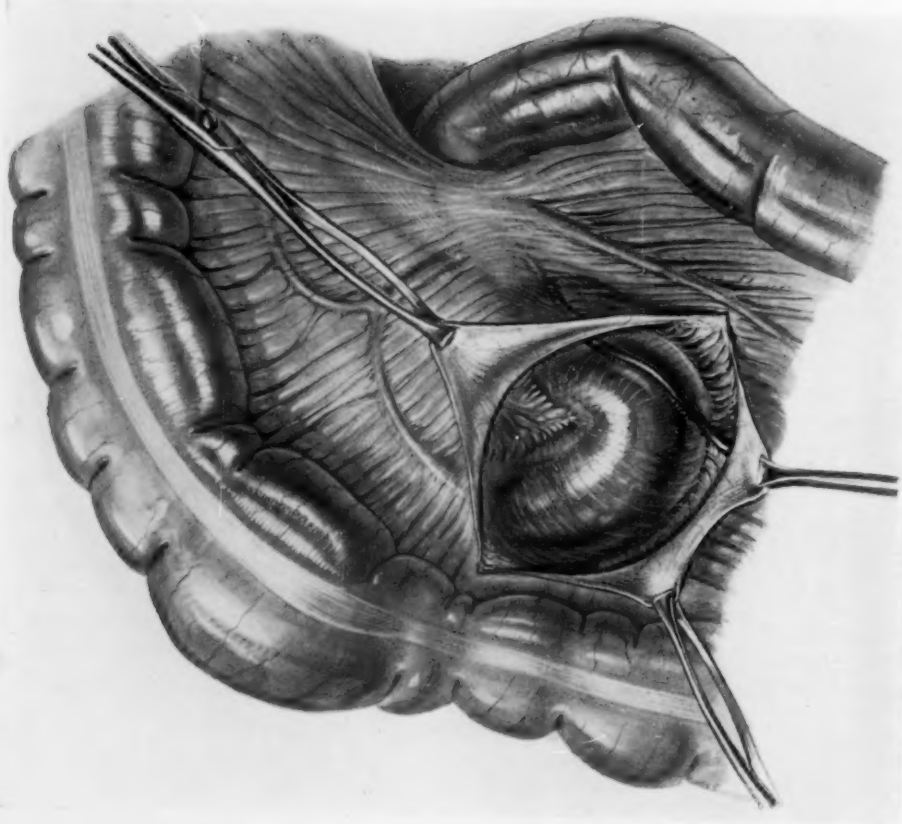


FIG. 17.—Duodeno-jejunostomy. The duodenum is exposed by an incision extending downward and inward. A large blood-vessel presents at the lower angle of the incision and may be easily injured. It should be represented in the peritoneal layer instead of behind it.

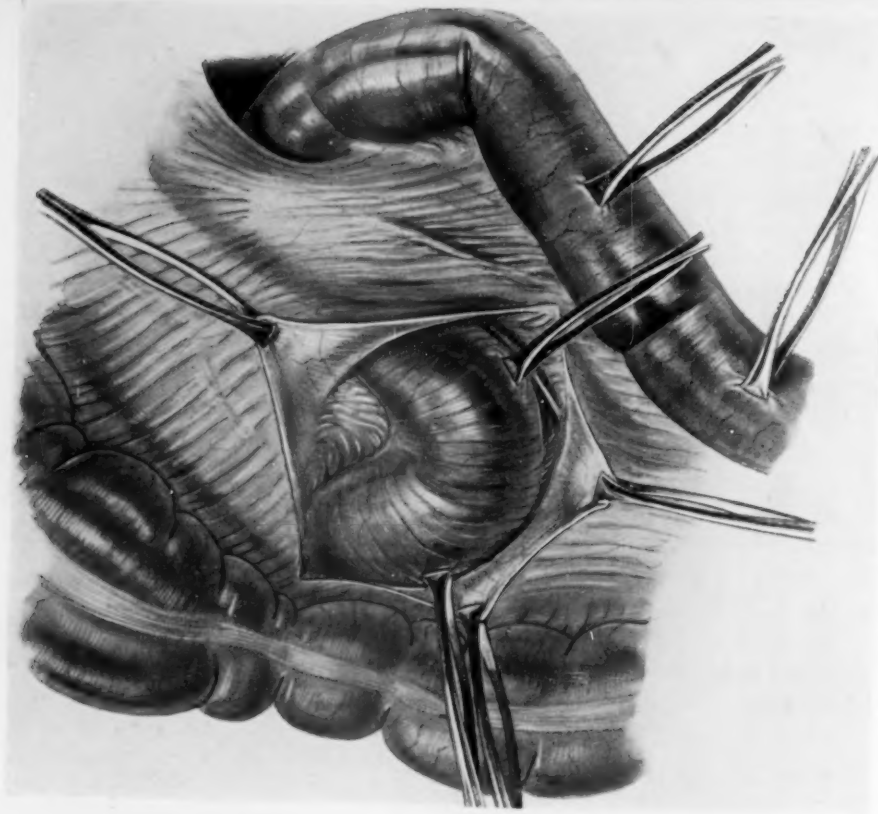


FIG. 18.—Duodeno-jejunostomy. Allis forceps are applied on the duodenum and jejunum to mark the points of the anastomosis.

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The total number reported to date is fifty-eight. There has been no mortality and in only one case (Mayo's) is the result said to have been unsatisfactory. The literature contains no study of the procedure and for this reason the following conclusions are offered:

The indications are:

1. Vicious circle after gastroenterostomy.
2. Accompanying gastroenterostomy when the duodenum is obstructed.

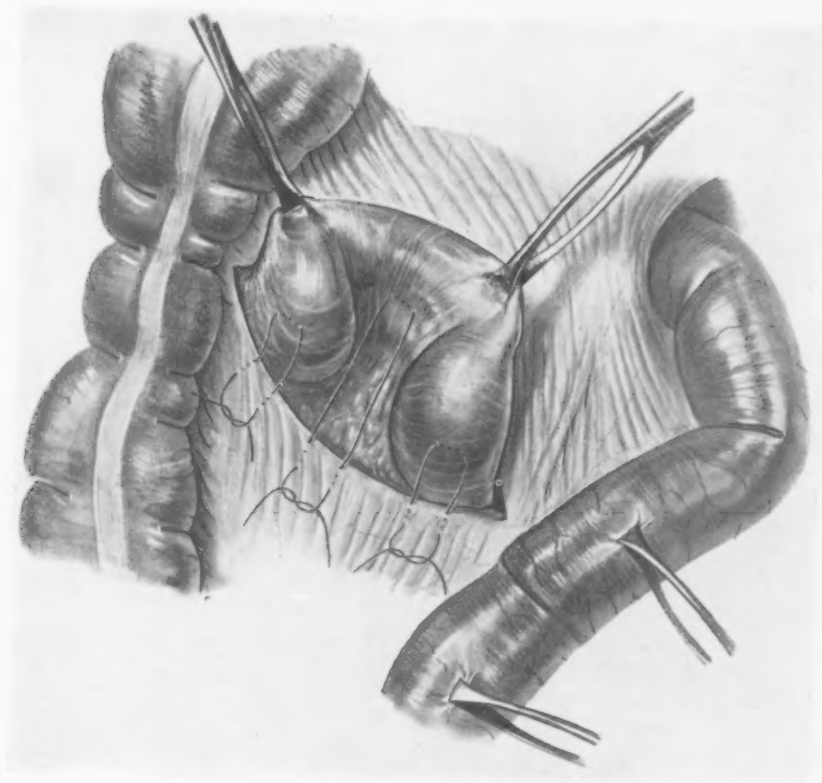


FIG. 19.—Duodeno-jejunostomy. The duodenum has been lifted from its bed after blunt dissection behind the second and third portions. Stitches are inserted for closing the peritoneal opening posteriorly. They pass through the peritoneal edge from without inward so as to invert the raw surface.

3. In place of gastroenterostomy in certain cases of duodenal ulcer.
4. Obstruction of the third portion of the duodenum, not responding to medical treatment, in which some other procedure is not specifically indicated.
5. Possibly in cases of congenital stenosis and acute gastromesenteric ileus.

Group One.—Cases of vicious circle follow one of two types. First, those who stand the condition well, in which the bile vomited is normal in color and odor, and strength is maintained. They frequently respond to lavage, immediately followed with food introduced through the stomach

tube, supplemented with peristaltic stimulants, massage, postural treatment and colon irrigations. If weight and strength progressively fail, however, operation will be required.

Second, those showing early toxic symptoms with marked prostration, subnormal temperature, rapid, feeble pulse, scanty urine and vomiting or regurgitation of dark bile having a fecal odor. These patients grow worse rapidly and require early operation. The procedure may consist of the treatment of angulations or adhesions, but usually duodeno-jejunostomy, with exclusion of pylorus, is advisable.

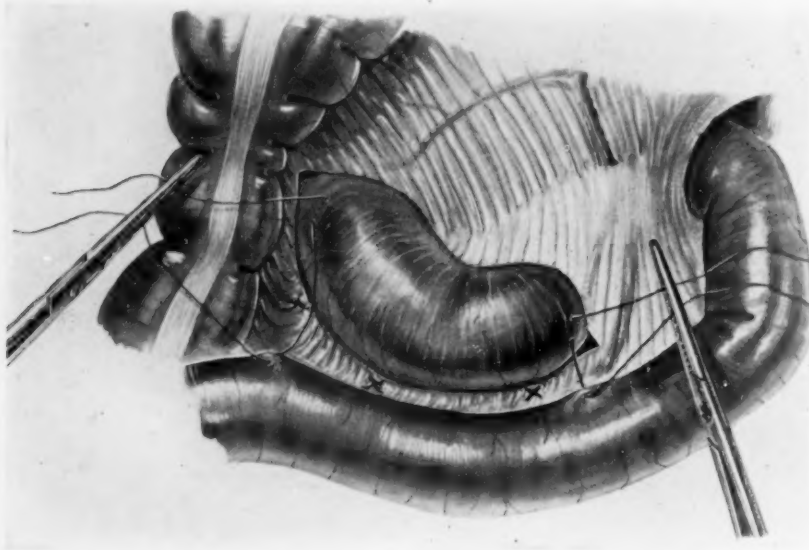


FIG. 20.—Duodeno-jejunostomy. Posterior peritoneal sutures are tied and traction stitches are inserted between the duodenum and jejunum. On the jejunal side they are close to the mesenteric border, so that the jejunal incision will be on the superior surface instead of the free border. These sutures aid in the manipulation of the duodenum, which tends to retract, and also prevent angulation at the point of anastomosis.

Group Two.—Accompanying gastroenterostomy when the duodenum is obstructed.

Gillon⁶⁰ considers gastroenterostomy an incomplete operation physiologically and recommends enteroenterostomy in all cases. American surgeons will consider this view extreme, but when it is done, one is impressed with the uniform smoothness of the convalescence. It is certain that some unfortunate results have been due to failure to recognize and to treat the duodenal obstruction.

Group Three.—As a substitute for gastroenterostomy in certain cases of duodenal ulcer. It is not uncommon for ulcer to complicate duodenal obstruction, and it has been suggested by Codman,¹⁷ Lane,²⁰ and the writer^{28, 29} that the duodenal obstruction is a predisposing cause. Codman,¹⁷ in particular, discusses the irritating properties of the pancreatic secretion and its effect upon the first portion of the duodenum. Occasion-

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ally a case will be found in which gastric acidity is normal or diminished. There may be a gastric delay and bile is usually present in the stomach. The pylorus instead of being obstructed is dilated, a pathological condition below causing obstruction of the duodenum. The usual procedure has consisted in gastroenterostomy with pyloric exclusion, but in certain cases, in which the dilatation was extreme, duodeno-jejunostomy has been performed, with the assumption that there is an advantage in relieving the predisposing pathological condition, without disturbing the physiology of the stomach. The cases are too few in number to justify positive conclusions, however.

Group Four.—*Obstruction of the third portion of the duodenum* is the largest group and the one of which I have had the greatest opportunity to make a study. Among these are included, not only cases of giant duodenum, but a greater number, which, though showing a lesser degree of obstruction, present a very definite symptom-complex.

TECHNIC OF DUODENO-JEJUNOSTOMY

The operation is similar to gastroenterostomy, but there are some practical points worth emphasizing. (See Figs. 16 to 22.)

Incision: Upper right rectus or transverse if there is reason to anticipate the encountering of adhesions from previous operation. The dependent portion of the duodenum is located retroperitoneally, below the transverse colon, in close relation to the hepatic flexure. The peritoneum is incised obliquely downward and inward and the opening enlarged sufficiently to give a satisfactory exposure. Large blood-vessels will present at the inner angle.

The duodenum is freed by blunt dissection behind the descending and transverse portions. Free mobilization adds to the ease of the subsequent procedure. The duodenum is drawn forward and the edge of the mesenteric opening is sutured to it posteriorly.

The dependent portion of the duodenum and the superior surface of the jejunum are approximated and held with traction stitches. A continuous suture of fine linen softened with vaseline is inserted, a gastroenterostomy clamp is applied, and a one and one-half-inch incision is made in the duodenum and a slightly shorter one in the jejunum. The suturing is then completed as in gastroenterostomy, particular attention being given to the angle stitches. In completing the outer anterior stitch, the approximation must usually be made entirely at the expense of the jejunum. This may be facilitated by inserting the jejunal stitch at right angles to the incision and the duodenal stitch parallel with it. The opening in the mesentery is closed anteriorly by suturing to the duodenum. The procedure is more difficult than gastroenterostomy, but post-operative experience leads to the conclusion that the mortality is lower and complications are less apt to occur.

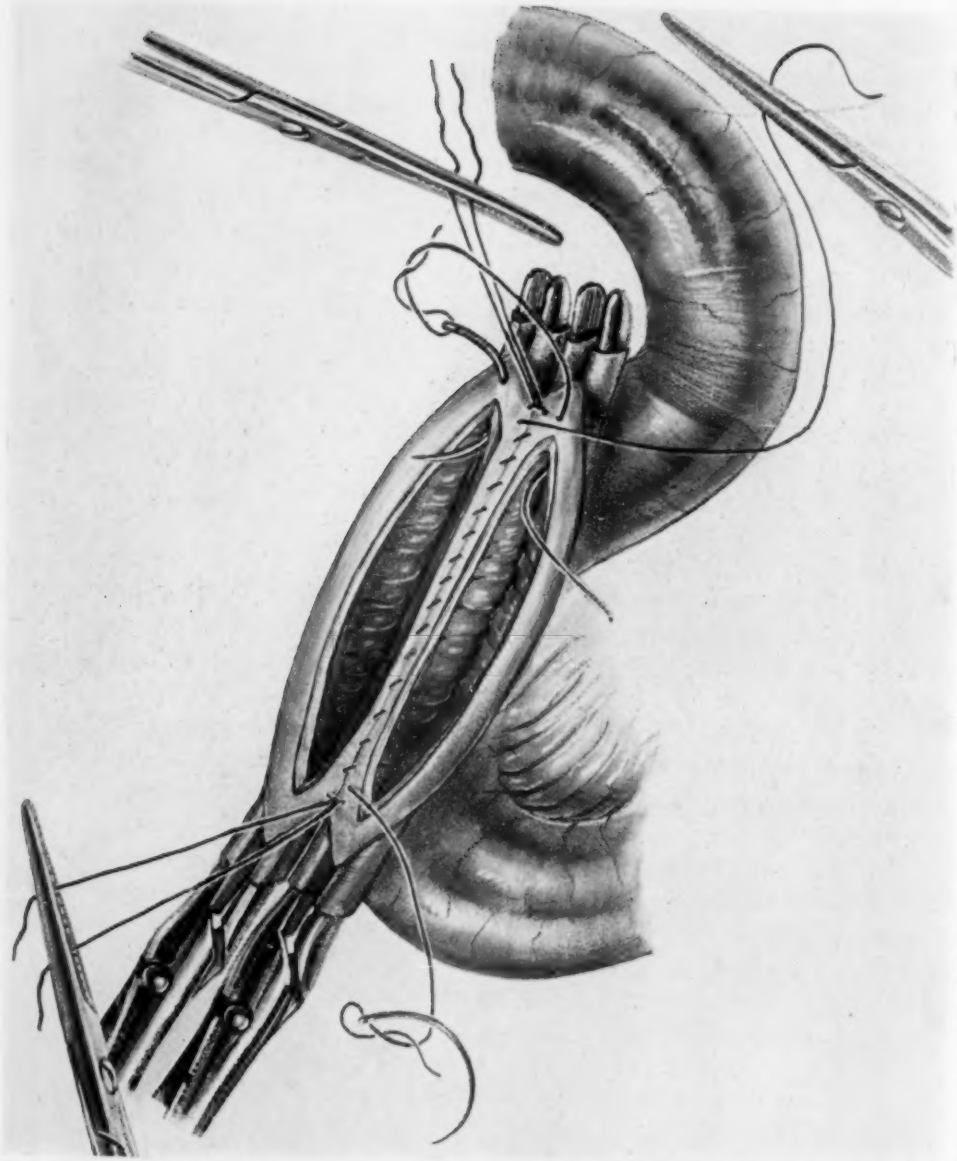


FIG. 21.—Duodeno-jejunostomy. Clamps are applied, traction stitches are tied, posterior suture of linen is inserted. The inner suture of chromic gut is started, indicating the care used in inserting the angle stitch. It is occasionally necessary to operate without a clamp on the duodenum.

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CASE REPORTS

The following is a résumé of our series treated by duodeno-jejunostomy: Total number, forty-one. First duodeno-jejunostomy performed in 1915. Males, sixteen; females, twenty-five. Ages, ten to twenty, two; twenty to thirty, twelve; thirty to forty, fifteen; forty to fifty, eight; fifty to sixty, three.

Previous operations were performed in 22 cases: Gastroenterostomy, 8; appendectomy, 12; tubal pregnancy, 1; hysterectomy, 2; cholecystostomy, 1; cholecystectomy, 2; nephropexy, 2; laparotomy, 1.

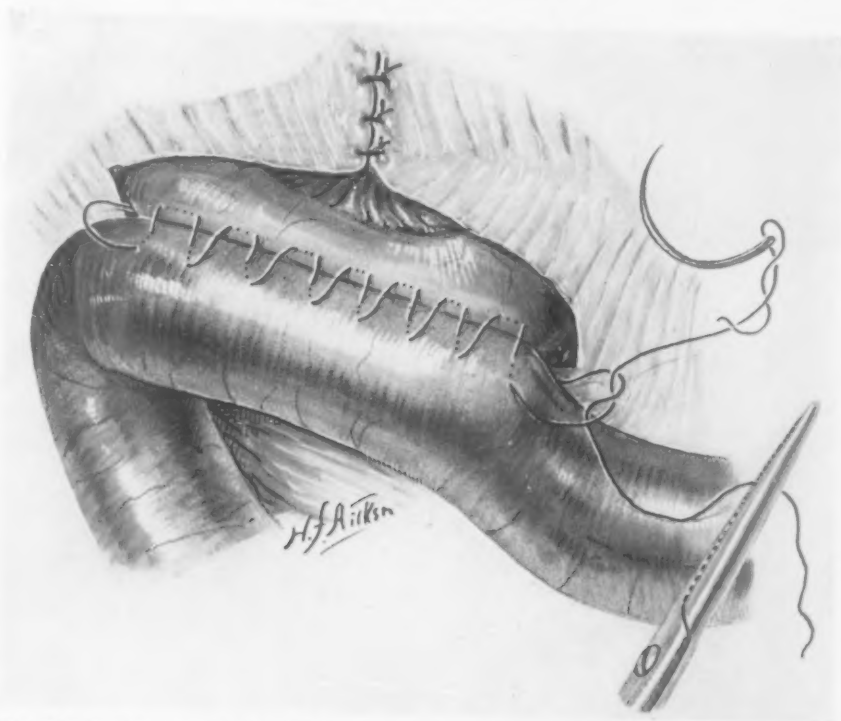


FIG. 22.—Duodeno-jejunostomy. The inner suture has been completed. The outer suture is inserted at right angles to the incision on the jejunal side and parallel with it on the duodenal side. This favors approximation at the expense of the jejunum which is frequently necessary because of the traction on the duodenum.

Symptoms have been grouped as follows: Headache, 27; regurgitation, 25; eructations, 30; borborygmus, 25; heartburn, 13; loss of weight, 35; constipation, 38; vomiting, 22; vomiting of bile, 19; vicious circle, 4; bilious attacks (constipation, headache and vomiting of bile), 9; pain, 34; localized in the epigastrium, 29; right hypochondrium, 7; at the duodeno-jejunal junction, 6; in the back, 9. The pain was definitely related to food in 11 cases. Dull in character in 11, sharp in 13, colic-like in 6. The gastric acidity was normal in 7, low in 9, high in 17 and not stated in 8. Impaired motor function and bile found in the fasting stomach was noted in 23 cases.

X-ray Report.—Correct diagnosis 18 in 33 examinations, ulcer wrongly diagnosed in 9 cases.

Pathology.—The stomach was dilated in 10 cases, ptosed in 3, and an ulcer found in 1. The duodenum showed an ulcer in 2 cases, was moderately dilated in 10, considerably in 11, greatly in 7, and not stated in 3. The cæcum was dilated in 15 cases, prolapsed in 10. Adhesions were about it in 4, and in 3 there was a Jackson membrane. The hepatic flexure showed adhesions or prolapse in 7 cases. Chronic appendicitis was found in 14. Adhesions or angulation at the gastroenterostomy opening found in 4 cases. The small intestines were in the pelvis in 4, the jejunum was angulated or adherent in 11.

The indications for which duodeno-jejunostomy was performed were as follows: 3 cases, 1 suggestive of gall-stones, the other 2 of chronic appendicitis, in which a dilated duodenum was found, 13 in which ulcer was suspected or diagnosed, but in which the pathology was a dilated duodenum, or adhesions about it, 3 cases, 2 with a duodenal ulcer and 1 with a gastric ulcer as well as a duodenal dilatation. In these a gastroenterostomy was also performed, 4 with vicious circle, 4 complaining of continued epigastric pain and vomiting of bile, after a previous gastroenterostomy had been performed by various surgeons and in which a dilated duodenum was demonstrated; 14 with epigastric pain, vomiting, or typical bilious attacks in which a dilated duodenum was suspected or diagnosed before operation. Four of these also showed ulcer of the duodenum. Of the 41 cases operated upon, 31 have been followed up to a recent date, and are so completely relieved of their symptoms that it is justified to classify them as cured; 5 cases were apparently cured at the time of their leaving the hospital, but we have been unable to get a subsequent report; 4 cases have been greatly improved, but still complain of some troublesome symptoms; one case feels that there has been no benefit from the operation.

The results convince us that duodeno-jejunostomy will save from invalidism a group of patients not amenable to other treatment, and should be recognized as a definite surgical procedure with well-defined indications and limitations.

The following case reports have been selected as illustrating variations in the problem of duodenal obstruction.

In the table a summary is given of the forty-one cases in which duodeno-jejunostomy was performed.

CASE I. *Indication: Vicious Circle.* No. 23, Mr. T. A., aged thirty-four years.

Past History.—Always constipated, symptoms of indigestion commenced in 1913. Appendectomy in 1914 gave temporary relief.

Present History.—Complains of frequent attacks of acid stomach with moderate pain one hour after meals and when stomach is empty, occasionally vomits acid material. Usually awakened at

Case number	Sex	Age	Number of months since operation	Previous operations	Symptoms constant = C or intermittent = I	Constipation	Vomiting	Character of Vomitus	Bilious attacks	Headache	Pain		Regurgitation	Eructations	Borborygmus	Heartburn
											Present	Location	Character			
1	P	25	72	Gastroenterostomy	I	+	+	Bile	-	+	+	Abdomen	Dull	+	+	+
2	M	34	48	Gastroenterostomy	C	+	+	Bile, vicious circle	-	+	+	.....	.....	+	+	+
3	F	24	48	Gastroenterostomy, appendectomy	I	+	+	Bile, food	-	+	+	Epigastrium	Dull	+	+	+
4	M	-	47	.....	I	+	-	No details	-	-	+	No details	.....	-	-	-
5	M	30	42	.....	I	+	-	.....	-	-	+	Epigastrium	Violent, 14 hr. p.c.	-	-	-
6	M	33	41	.....	I	+	-	.....	-	+	+	Epigastrium	Sharp, before meals	+	+	-
7	F	37	41	Tubal pregnancy	I	+	-	.....	-	-	+	Epigastrium	Sharp, before meals	-	-	-
8	M	23	39	Appendectomy	I	+	+	Acid, food; bile at the end	-	+	+	Epigastrium	Sharp, 2 1/2 hrs. p. c.	-	-	-
9	M	46	39	Gastroenterostomy	C	+	+	Bile, food	-	-	-	Epigastrium and back, relieved by food	worse p.c.	+	+	+
10	F	47	37	Hysterectomy, cholecystostomy	I	+	+	Bile, large amount	+	-	-	Soreness in epigastrium	.....	+	+	+
11	F	36	37	.....	C	+	+	Bile	+	+	+	Back and abdomen	Dull	+	+	+
12	F	37	36	Gastroenterostomy, appendectomy	I	+	-	.....	-	+	+	Epigastrium, right hypochondrium	Cramping or dull	-	+	+
13	F	20	36	.....	C	+	+	Acid fluid	-	-	+	Epigastrium radiating to both sides and to left shoulder	.....	+	+	+
14	F	40	36	Appendectomy, floating kidney	I	+	-	.....	-	+	+	Epigastrium between shoulders	Sharp	-	-	-
15	F	31	36	.....	I	+	-	.....	-	+	+	Epigastrium increased by food	Dull	+	+	+
16	F	39	35	Appendectomy, nephropexy	I	+	+	No bile	-	+	+	Epigastrium and under sternum	Cramp like	-	+	+
17	F	22	33	.....	C	+	+	Bile	+	+	+	Epigastric after food	Sharp	+	+	+
18	F	44	33	Appendectomy, cholecystectomy	I	+	+	Bile	+	+	-	.....	.....	+	+	+
19	F	26	32	Appendectomy	I	+	-	.....	-	+	+	Epigastrium	Dull, sharp, boring and cramping	+	+	+
20	F	60	21	Gastroenterostomy	C	+	+	Bile, vicious circle	+	+	-	Soreness in epigastrium	.....	+	+	+
21	M	28	30	.....	I	+	+	Bile	-	-	+	Epigastrium 2 hrs. p.c.	.....	+	+	+
22	M	37	30	.....	I	+	-	.....	-	+	+	Back, distress in epigastrium	Dull girdle sensation	-	-	-
23	M	34	29	Appendectomy, gastroenterostomy	C	+	+	Bile, vicious circle	-	+	-	Not since gastroenterostomy	.....	+	+	+
24	M	28	29	.....	I	+	-	.....	-	-	+	Epigastrium, 4 hrs. p. c.	Colic like	-	-	-
25	F	18	29	.....	I	+	+	Bile	+	+	+	Over appendix	Discomfort under liver	-	-	-
26	M	25	28	Gastroenterostomy	C	+	+	Bile, vicious circle	-	-	-	Not since gastroenterostomy	.....	-	-	-
27	F	35	25	Appendectomy	I	+	+	Bile, mucus	+	+	-	Discomfort in upper abdomen	.....	+	+	+
28	M	36	24	.....	I	+	-	.....	-	+	+	Under liver and to left of navel, 1 hr. p. c.	.....	+	+	+
29	F	40	20	No history of the case	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	F	33	19	.....	I	+	-	.....	-	+	+	In lower right quadrant	.....	+	+	+
31	M	50	12	Laparotomy	I	+	-	.....	-	-	+	Under left costal arch	Dull	-	+	+
32	F	25	12	Appendectomy	I	+	-	.....	-	+	+	Intense boring in back worse 2 hrs. p. c.	.....	-	-	-
33	M	39	12	.....	I	+	-	Nauseated	-	+	+	Burning sensation in epigastrium	.....	+	+	+
34	F	26	11	.....	C	+	+	Food, acid; bile at end	+	+	+	Epigastric	Severe	-	+	-
35	F	36	11	Appendectomy	I	+	+	Bile and mucus	-	-	+	Backache	.....	+	+	+
36	F	50	9	Hysterectomy	I	+	-	.....	-	+	+	Intense burning sensation	.....	+	+	+
37	F	40	9	Hysterectomy	I	+	-	.....	-	+	+	Epigastrium, back	.....	+	+	+
38	F	47	4	Cholecystectomy, appendectomy	I	+	+	Bile	-	-	+	Epigastrium, p. c.	Cramp like	+	+	+
39	F	22	4	.....	I	+	-	.....	-	+	-	.....	.....	+	+	+
40	M	43	4	.....	I	+	+	Bile, large amount	+	+	+	Epigastrium	Cramp like	+	+	-
41	M	24	2	.....	I	+	+	Not stated	-	-	+	Epigastrium, relieved by food	.....	-	+	+

Eruptions	Borborygmus	Heartburn	Loss of weight	Free HCl Ewald meal	Gastric delay	Lavage of fast- ing stomach	X-ray report	Clinical diagnosis	Pathology				Procedure	
									Stomach	Duodenum	Cæcum	Other conditions	Duodeno- jejunostomy	Other procedures
+	+	+	+	Normal	-	Bile	None	Duodenal adhesions	Adhesions	Dilated	Not stated	None	+	Pyloric exclusion
+	+	+	+	None	-	Bile	None	Vicious circle	Normal	Dilated	Not stated	None	+	Pyloric exclusion
+	+	+	+	Low	-	Bile	None	Adhesions	Normal	Dilated	Not stated	None	+	None
-	-	-	+	40	+	Empty	None	None stated	Dilated	Dilated, ulcer	Normal	None	+	Gastroenterostomy
+	-	-	+	80	+	Empty	Ulcer and adhesions of duodenum	Duodenal ulcer	Pylorus con- tracted	Dilated, ulcer	Normal	Jejunal adhesions	+	Gastroenterostomy
-	-	-	-	0	-	Bile	Ulcer of duodenum, di- lated stomach	Duodenal ulcer	Dilated	Dilated	Not stated	Chronic appendicitis	+	Appendectomy
-	-	-	+	Excessive	-	Mucus	Gall-stones	Ulcer, chronic appendi- citis	Normal	Dilated, ulcer scar	Not stated	Chronic appendicitis	+	Appendectomy
+	+	-	+	No note	..	Occasionally a little bile	Penetrating ulcer of du- odenum	Duodenal ulcer and dila- tation	Not stated	Dilated, ulcer	Dilated, adhesions	Constriction at duodeno- jejunal juncture	+	None
+	+	+	+	0	+	Bile	Gastroenterostomy open- ing functionates	Duodenal obstruction	Ulcer scar, pylor- us patent	Greatly dilated	Not stated	None	+	None
+	+	+	+	48	+	Bile mucus	Ulcer of duodenum	Duodenal obstruction, in- competent pylorus	Dilated	Adhesions to gall- bladder	Involving hepatic flexure and du- odenum	.....	+	Adhesions divided
+	+	-	-	0	-	No report	Unsatisfactory	Duodenal obstruction, cecal stasis	Prolapsed	Dilated +++	Dilated	Chronic appendicitis, Jackson's membrane	+	Adhesions divided, appen- dectomy
+	+	-	+	Increased	+	Bile mucus	Delay in duodenum	Exploratory duodenal obstruction	Adhesions at gas- troenterostomy opening	Dilated ++	Not stated	.....	+	None
-	-	-	+	45	+	Bile mucus	Gastric duodenal obstruc- tion	Possible ulcer	No ulcer	Dilated	Dilated	Chronic appendicitis, jejunal adhesions	+	Appendectomy
+	+	-	+	22	+	Bile mucus	Negative	Exploratory probable ulcer	Normal	Dilated +++	Adhesions of he- patic flexure	.....	+	Adhesions divided
+	+	-	+	In excess	+	Mucus	Negative	Ulcer	Pyloric ulcer	Dilated +++	Not stated	Adhesions at duodeno- jejunal puncture	+	None
+	+	-	-	12	+	Bile	Giant duodenum	Duodenal obstruction, cecal stasis	Dilated	Dilated ++++	Dilated, prolapsed	Hepatic flexure prolapsed	+	Plication and fixation of cæcum
+	+	+	-	48	+	Bile mucus	Gastric ulcer, appendi- citis (dilated duodenum)	Duodenal obstruction, in- testinal stasis	Pylorus dilated	Dilated	Dilated, prolapsed	Small intestines in pelvis	+	Appendectomy, plication and fixation of cæcum
+	+	-	+	40	-	Not noted	Gastric ulcer, cecal stasis	Duodenal stasis	Dilated	Dilated ++	Dilated, prolapsed	Small intestines in pelvis	+	Plication and fixation of cæcum
+	+	+	+	0	+	Bile	Dilated duodenum, cecal stasis	Dilated duodenum, gall- stones	Dilated	Dilated adhesions from gall-bladder	Dilated, prolapsed	None	+	Duodeno-duodenostomy, plication, fixation of cæcum
+	+	-	+	10	+	Bile	Not made	Vicious circle	Opening patent	Dilated +++	Not stated	Adhesions of jejunum	+	Pyloric exclusion
-	-	-	-	Normal	+	Bile mucus	Negative	Dilated duodenum	Not stated	Dilated, no ulcer	Dilated, prolapsed	Adhesions at hepatic flexure	+	Appendectomy, plication, fixation of cæcum
+	+	+	+	Not noted	..	Bile	Dilated duodenum, ulcer, chronic appendicitis	Intestinal stasis, possible duodenal ulcer	Not stated	Dilated ++	Dilated, prolapsed	Chronic appendicitis	+	Appendectomy, plication of cæcum
+	+	+	+	62	-	Not noted	Not made	Vicious circle	Normal	Adhesions at gas- troenterostomy opening	.....	None	+	None
-	-	-	+	50	+	Empty	Not made	Duodenal ulcer	Ulcer dilated +++	Adhesions	Adhesions	Adhesions of duodenum to gall-bladder and colon	+	Appendectomy, plication, fixation of cæcum
-	-	-	+	Not noted	+	Bile	Not made	Appendicitis	Ptosed, dilated	Dilated ++++	Dilated	Appendix thickened	+	Appendectomy, plication of cæcum
+	+	-	+	0	+	Bile mucus	Not made	Vicious circle	Normal	Dilated +++	Jejunum angulated by adhesions	None	+	Exclusion of pylorus
+	-	+	+	80	-	Not noted	Dilated duodenum, cecal stasis	Duodenal obstruction, in- competent pylorus	Not stated	Dilated ++	Dilated, prolapsed	Adhesions at hepatic flexure	+	Appendectomy, plication, fixation of cæcum
..	Dilated atonic duodenum	Chronic appendicitis	Not stated	Dilated, adhesions to gall-bladder	Chronic appendi- citis	Adhesions of cæcum and ascending colon	+	Appendectomy
+	+	-	+	40	+	Bile mucus	Gastric ulcer, duodenal adhesions	Not stated	Not stated	Not stated	Not stated	None	+	Appendectomy, adhesions divided
+	+	+	+	Not stated	..	.....	Gastric ulcer, duodenal delay	Intestinal stasis	No ulcer	Dilated ++++	Dilated	Chronic appendicitis, small intestines in pelvis	+	Appendectomy, plication of cæcum
+	+	-	+	38	-	Mucous acid fluid	Duodenal ulcer	Not stated	No ulcer; adhesions colon	ns involving gall- and duodenum di- lated	bladder, transverse	None	+	Plication of cæcum, adhe- sions divided
+	+	+	+	Normal	-	Empty	Duodenal stasis, mobile cæcum	Duodenal ulcer	Not stated	Adhesions to gall- bladder. Duo- denum and cæcum dilated	Narrowing at duodeno- jejunal juncture	None	+	Cæcum plicated
+	-	-	+	24	-	A little bile	Chronic appendicitis	Duodenal ulcer	Not stated	Extending to pelvic brim	Dilated	Chronic appendicitis	+	Appendectomy, plication, fixation of cæcum
+	+	+	+	Normal	+	Bile	Duodenal stasis, appen- dicular adhesions	Duodenal obstruction	Normal	Dilated ++	Mobile	Chronic appendicitis	+	Appendectomy, plication of cæcum
+	+	+	+	38	+	Bile mucus	Adhesions of duodenum and cæcum	Intestinal stasis, duodenal obstruction	Normal	Dilated to size of stomach	Adhesions	Adhesions of sigmoid	+	Adhesions divided
+	+	+	+	In excess	+	Empty	Gastric ulcer, duodenal adhesions	Not stated (no ulcer)	No ulcer	Dilated ++	Not stated	Chronic appendicitis	+	Appendectomy, adhesions divided
+	+	-	+	Not stated	..	Bile	Obstructed duodenum	Duodenal delay	Normal	Dilated +++	Dilated	Chronic appendicitis	+	Appendectomy, plication of cæcum
+	+	-	+	Not stated	..	Bile	Negative	Duodenal obstruction	Dilated	Dilated +++	Dilated	None	+	Adhesions divided
+	+	+	+	Moderate	+	Not stated	Duodenal stasis	Duodenal stasis	Normal	Dilated	Jackson's membrane	None	+	Adhesions divided
+	-	-	+	66	+	Acid fluid	Duodenal ulcer	Duodenal obstruction and ulcer	No ulcer	Dilated +++	Dilated	Chronic appendicitis	+	Appendectomy, plication of cæcum
+	-	+	+	Not stated	..	.....	Ileal stasis	.....	Ulcer	Dilated	.....	Chronic appendicitis	+	Gastroenterostomy, ap- pendectomy

	Pathology				Procedure		Results: Imp = improved C = cured
	Stomach	Duodenum	Cæcum	Other conditions	Duodeno- jejunostomy	Other procedures	
	Adhesions	Dilated	Not stated	None	+	Pyloric exclusion	C
	Normal	Dilated	Not stated	None	+	Pyloric exclusion	C
	Normal	Dilated	Not stated	None	+	None	C
	Dilated	Dilated, ulcer	Normal	None	+	Gastroenterostomy	C
	Pylorus con- tracted	Dilated, ulcer	Normal	Jejunal adhesions	+	Gastroenterostomy	C
	Dilated	Dilated	Not stated	Chronic appendicitis	+	Appendectomy	C
endi-	Normal	Dilated, ulcer scar	Not stated	Chronic appendicitis	+	Appendectomy	C
dila-	Not stated	Dilated, ulcer	Dilated, adhesions	Constriction at duodeno- jejunal juncture	+	None	C
n	Ulcer scar, pylor-	Greatly dilated	Not stated	None	+	None	C
in-	Dilated	Adhesions to gall- bladder	Involving hepatic flexure and du- odenum	.....	+	Adhesions divided	C
tion,	Prolapsèd	Dilated +++	Dilated	Chronic appendicitis, Jackson's membrane	+	Adhesions divided, appen- dectomy	C
renal	Adhesions at gas- troenterostomy opening	Dilated ++	Not stated	.....	+	None	C
	No ulcer	Dilated	Dilated	Chronic appendicitis, jejunal adhesions	+	Appendectomy	C
le	Normal	Dilated +++	Adhesions of he- patic flexure	.....	+	Adhesions divided	C
	Pyloric ulcer	Dilated +++	Not stated	Adhesions at duodeno- jejunal puncture	+	None	C
ion,	Dilated	Dilated ++++	Dilated, prolapsed	Hepatic flexure prolapsed	+	Plication and fixation of cæcum	C
in-	Pylorus dilated	Dilated	Dilated, prolapsed	Small intestines in pelvis	+	Appendectomy, plication and fixation of cæcum	C
	Dilated	Dilated ++	Dilated, prolapsed	Small intestines in pelvis	+	Plication and fixation of cæcum	C
gall-	Dilated	Dilated adhesions from gall-bladder	Dilated, prolapsed	None	+	Duodeno-duodenostomy, plication, fixation of cæcum	C
	Opening patent	Dilated +++	Not stated	Adhesions of jejunum	+	Pyloric exclusion	Imp
	Not stated	Dilated, no ulcer	Dilated, prolapsed	Adhesions at hepatic flexure	+	Appendectomy, plication, fixation of cæcum	C
able	Not stated	Dilated ++	Dilated, prolapsed	Chronic appendicitis	+	Appendectomy, plication of cæcum	C
	Normal	Adhesions at gas- troenterostomy opening	.....	None	+	None	C
	Normal	Ulcer dilated +++	Adhesions	Adhesions of duodenum to gall-bladder and colon	+	Appendectomy, plication, fixation of cæcum	C
	Ptosed, dilated	Dilated ++++	Dilated	Appendix thickened	+	Appendectomy, plication of cæcum	C
	Normal	Dilated +++	Jejunum angulated by adhesions	None	+	Exclusion of pylorus	C
in-	Not stated	Dilated ++	Jackson's mem- brane	None	+	Adhesions divided	C
	Not stated	Dilated, adhesions to gall-bladder	Chronic appendi- citis	Adhesions of cæcum and ascending colon	+	Appendectomy	C
	Not stated	Not stated	Not stated	None	+	Appendectomy, adhesions divided	C
	No ulcer	Dilated ++++	Dilated	Chronic appendicitis, small intestines in pelvis	+	Appendectomy, plication of cæcum	Un- imp.
	No ulcer; adhesio- ns involving gall- colon	.....	bladder, transverse	None	+	Plication of cæcum, adhe- sions divided	C
	Not stated	Adhesions to gall- bladder and cæ- cum	Dilated	Narrowing at duodeno- jejunal juncture	+	Cæcum plicated	C
	Not stated	Extending to pelvic brim	Dilated	Chronic appendicitis	+	Appendectomy, plication, fixation of cæcum	C
	Normal	Dilated ++	Mobile	Chronic appendicitis	+	Appendectomy, plication of cæcum	C
renal	Normal	Dilated to size of stomach	Adhesions	Adhesions of sigmoid	+	Adhesions divided	C
	No ulcer	Dilated ++	Not stated	Chronic appendicitis	+	Appendectomy, adhesions divided	Imp.
	Normal	Dilated +++	Dilated	Chronic appendicitis	+	Appendectomy, plication of cæcum	C
	Dilated	Dilated +++	Dilated	None	+	Adhesions divided	Imp.
	Normal	Dilated	Jackson's membrane	None	+	Adhesions divided	Imp.
and	No ulcer	Dilated +++	Dilated	Chronic appendicitis	+	Appendectomy, plication of cæcum	C
...	Ulcer	Dilated	.....	Chronic appendicitis	+	Gastroenterostomy, ap- pendectomy	C

	Results: Imp = improved C = cured	Symptoms still persisting	Remarks
	C	None	
	C	Vague discomfort	Apparently pyloric exclusion and duodeno-jejunos- tomy should have accompanied first operation.
	C	None	Gastroenterostomy might have been avoided by a primary duodeno-jejunos- tomy.
	C	None	Detailed history is not available.
	C	None	
	C	None	Clinical and X-ray diagnosis wrong.
	C	None	Duodenal dilatation was marked but was not recog- nized.
	C	After 3 yrs. complains of hyperacidity responding to medical treatment	Because of excessive secretion of HCl, gastroenteros- tomy and pyloric exclusion might have been preferable but the dilated duodenum dominated the pathology.
	C	None	Inspection of duodenum at first operation would proba- bly have shown the need of a duodeno-jejunos- tomy.
	C	None	The hyperæsthesia seemed to be caused by the bile and pancreatic fluid.
ea-	C	Still constipated	Resection of the cæcum might have been better but the result has been satisfactory.
	C	None	
	C	None	No report since leaving the hospital.
	C	Constipation	Gastroenterostomy with pyloric exclusion might have been done.
	C	None	
a of	C	None	Case of giant duodenum; nervous depression was marked; cure was spectacular.
ion	C	None	Giant duodenum.
um	C	Constipation improved	
a of	C	None	
ny,			
of			
	Imp	Vomits occasionally when constipated	Ulcer was found at first operation. First portion of duodenum was also found dilated then.
ion,	C	None	
tion	C	Has had return of head- aches	Headaches are periodical and are probably due to chronic malarial poisoning.
	C	None	
ion,	C	No report for last year	Because of excessive amount of HCl it would have been better to also have done a gastroenterostomy with pyloric exclusion.
tion	C	None	Giant duodenum overshadowed the condition of the appendix.
	C	None	Apparently there was no justification for gastro- enterostomy in this case.
	C	Still depressed at times	
	C	Constipation and nervous- ness improved	The duodenum was hugely dilated.
sions	C	None	
tion	Un- imp.	Left hospital apparently cured but returned stat- ing that she had not been benefited	
dhe-	C	No report since leaving the hospital	
	C	Backache entirely relieved	
ion,	C	Well up to last March; no report since	
tion	C	Constipated at times	
	C	Has attacks of colitis at times	Giant duodenum.
sions	Imp.	Is nervous and consti- pated, burning of the cheek	Has gained weight and strength.
tion	C	.....
	Imp.	.....	Stormy convalescence with vomiting, constipation and an infected wound and pyæmic abscesses and ventral hernia. Apparently much improved.
ation	Imp.	Some headache and con- stipation	
ap-	C	Occasional headache	
	C	No report since leaving hospital	

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4.00 A.M. with nervousness, headache and sour eructations which are relieved by forced vomiting.

Physical Examination.—Stomach normal to palpation. Duodenum demonstrated by percussion as dilated. Motor tests show a gastric delay. Fasting stomach empty. Ewald test meal—free hydrochloric acid, 34. *Operation*, June, 1918.

Pathology.—Ulcer at the pylorus causing partial obstruction. No note made as to condition of duodenum.

Procedure.—Posterior gastroenterostomy with pyloric exclusion.

Result.—After five days patient commenced vomiting large quantities of bile. Lavage, cathartics and postural treatment gave no relief. Gradually grew weaker with subnormal temperature and scanty urine elimination.

Second Operation (July, 1919, for vicious circle).—*Pathology.*—Adhesions found at point of anastomosis, gastroenterostomy opening admitted three fingers. Pylorus still closed. Duodenum not dilated, probably because the bile flowed freely into the stomach. *Procedure.*—Duodeno-jejunostomy. *Result.*—Complete recovery. Remains well up to the present time.

Remarks.—Duodenal obstruction was suspected from the physical examination, but was overlooked at the first operation. Duodeno-jejunostomy should have supplemented the gastroenterostomy at the original operation.

CASE II. *Indication: Dilated Duodenum After a Previous Gastroenterostomy.* Number 3, Miss D. B., aged twenty-four years.

Past History.—For many years complained of indigestion, constipation, headaches, vomiting spells and cramp-like pains in the upper abdomen, not related to meals. Accustomed to wash out her own stomach frequently. Appendectomy in March, 1915, without improvement. Gastroenterostomy in October, 1915, with relief for eighteen months.

Present History.—Complains of epigastric pain, heartburn, headache, backache, constipation, and vomiting of food and bile.

Operation, February, 1917. *Pathology.*—Markedly dilated duodenum. *Procedure.*—Duodeno-jejunostomy. *Result.*—All symptoms disappeared and the patient has remained well up to the present time.

CASE III. *Indication: Dilated Duodenum Subsequent to Gastroenterostomy.* Number 12, Miss M. R., aged thirty-seven years.

Past History.—Appendectomy and gastroenterostomy for gastric ulcer in 1915. Well for one year.

Present History.—For two years has had recurring attacks of indigestion, occurring about once in two weeks, dull aching pain in epigastrium, in right hypochondrium and at the left of the navel, becoming cramp-like at times. During the attacks, food increased the discomfort. Frequently became nauseated but did not vomit.

Examination.—Abdominal tenderness in right hypochondrium, at the left of the navel and in the lower left quadrant. Slight rigidity of the upper right rectus. Stomach outline normal, duodenum not

outlined. No free HCl. The X-ray showed a slight delay in the stomach and duodenal cap.

Operation, January, 1918. *Pathology*.—Gastroenterostomy patent, adhesions about it. Entire duodenum dilated.

Procedure.—Duodeno-jejunostomy.

Result.—Complete recovery, has remained well for two years.

Remarks.—There is no information as to the condition of the duodenum before the first operation. Apparently the obstruction resulted from adhesions following the first operation. Bile did not regurgitate readily and for that reason pain was a prominent symptom.

CASE IV. *Indication: Dilated Duodenum, After a Previous Gastroenterostomy*. Number 1, Miss A. B., aged twenty-five years.

Past History.—In 1912 she began to have abdominal distress following meals and attacks of vomiting from one-half to two hours after meals. Vomitus was sour, but did not show retention. In 1913 a gastroenterostomy was performed which greatly relieved her for a year, although she had occasional attacks of vomiting.

Present History.—For past six months all symptoms have returned. Has lost forty pounds in weight. Marked headache and weakness. After admission to the hospital patient vomited after nearly every meal.

Examination.—Slight tenderness in upper right quadrant and in left iliac region. Dermatitis over left thigh. The test meal showed normal secretion.

Exploratory operation, January, 1915. *Pathology*.—Adhesions between the stomach and gall-bladder. The duodenum was markedly dilated and presented prominently below the transverse colon.

Procedure.—Adhesions divided, pylorus occluded, duodeno-jejunostomy performed.

Result.—For five days vomited frequently, after which all symptoms cleared up. She has continued perfectly well for five years.

Remarks.—The diagnosis was not made until the abdomen was opened. It is probable that the condition existed prior to the first operation, but may have been produced by it. The indications for the original gastroenterostomy do not appear to have been very clear. The recovery was complete and spectacular.

CASE V. *Indication: Dilated Duodenum*. Number 7, Miss D. B., aged thirty-seven years.

Past History.—Operation for tubal pregnancy in 1913. Pyelitis in 1915.

Present History.—Since 1916 has complained of epigastric pain before, during or immediately after meals, not relieved by food, but relieved by lying flat on her back.

Physical Examination.—Negative, except for moderate epigastric tenderness. Three out of four thread tests showed a trace of blood. Ewald test meal: Specimen scanty, largely mucus; free HCl, none; total acidity, 30.

A modified ulcer treatment gave relief for a time, but after ten

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months the symptoms returned and at this time there was tenderness over the region of the appendix. A test meal showed free HCl of 28. Motor function tests showed a slight gastric delay. No bile found in the stomach. The X-ray suggested gall-stones.

Exploratory operation in August, 1917. *Pathology*.—Appendix thickened, covered with light adhesions. Duodenum hugely dilated. On its anterior wall was the scar of a small ulcer apparently healed. There were adhesions between the gall-bladder and duodenum, but no gall-stones.

Procedure.—Appendectomy, division of adhesions, duodeno-jejunostomy.

Result.—Uneventful convalescence. Remains well, three years after operation.

Remarks.—The duodenal dilatation was not recognized by the physical or X-ray examination. The gastric analysis was not suggestive of ulcer. Chronic appendicitis might have given the symptoms, but with the pathology described, appendectomy alone would probably have failed to cure. Gastroenterostomy with pyloric exclusion was considered, but since the acidity was not high, the ulcer apparently healed and the dilated duodenum dominated the pathology, duodeno-jejunostomy seemed indicated.

CASE VI. Indication: Dilatation of Entire Duodenum. Number 25, Miss S. L., aged twenty-five years.

Past History.—Appendectomy in 1918 for same symptoms now complained of.

Present History.—For ten years has had "terrible" backache, located between shoulder blades. It is described as intense and boring in character. During attacks it is continuous, but much worse about two hours after meals. Has acid regurgitation and frequent eructations, is constipated, nervous and depressed.

Examination.—Stomach normal in size and position, duodenum cannot be outlined, cæcum and ascending colon distended with gas. Sensitive to pressure in epigastrium, liver normal. Test meal: Free HCl 38. Motor tests show normal motor function. Lavage of fasting stomach shows mucus and acid fluid. Tests for occult blood, negative.

X-ray diagnosis, duodenal stasis, probably caused by adhesions at beginning of third portion, mobile cæcum, dilated and ptosed in pelvis. Medical treatment was undertaken without benefit and operation ultimately advised.

Operation, January 23, 1920. Pathology.—Definite bands extended from gall-bladder across the second portion of duodenum to transverse colon. There was a distinct narrowing of intestine at duodeno-jejunal junction, entire duodenum dilated, cæcum prolapsed and dilated.

Procedure.—Adhesions divided, cæcum plicated and sutured to posterior peritoneum, duodeno-jejunostomy.

Result.—Uneventful convalescence, backache entirely relieved,

bowels regular. One year from date of operation patient remains well, has gained in weight and strength.

Remarks.—The pain in back sometimes takes the place of abdominal pain. Because of its severity and relation to meals, duodenal ulcer was suspected. In this case no bile regurgitated into stomach and pain was the most prominent symptom, presumably because the pylorus did not yield to the pressure.

CASE VII. Indication: Markedly Obstructed Duodenum with an Incompetent Pylorus. Number 10, Mrs. E. B., aged forty-seven years.

Past History.—Digestive trouble for two and one-half years. Hysterectomy and cholecystostomy performed.

Present History.—Complains particularly of hyperæsthesia of tongue, œsophagus, and stomach. Every week or two she vomits large quantities of bile and in the interim frequently regurgitates it. There is no pain, but a very sore feeling in the upper abdomen. She complains of weakness and has lost weight.

Examination.—HCl diminished, motor tests show delay. Slight resistance over upper right rectus, percussion of duodenum shows moderate dilatation. There is moderate tenderness in this region. Lavage of fasting stomach shows bile constantly present. X-ray report suggests duodenal ulcer but does not refer to duodenal dilatation.

Operation, December, 1917. Pathology.—No ulcer demonstrated. Adhesions at hepatic flexure of colon involving gall-bladder and duodenum. The latter was dilated, extending for three fingers' breadth below attachment of transverse colon, pylorus dilated.

Procedure.—Adhesions divided, duodeno-jejunostomy performed.

Result.—Vomiting and bile regurgitation has ceased, abdominal soreness and hyperæsthesia have disappeared, appetite improved, has gained in weight and strength, remains well after three years.

Remarks.—It is probable that this condition existed from the beginning of her illness, and that the previous operations were performed under the impression that her digestive symptoms were reflex. The diagnosis was easily made from the history and physical examination in spite of the negative X-ray report. The failure of the X-ray examination to demonstrate the condition may have been due to improper technic or to the fact that because of the incompetent pylorus permitting regurgitation of bile, the dilatation was not constantly present. The hyperæsthesia was probably due to irritation by the regurgitated bile.

SUMMARY

1. Chronic duodenal obstruction occurs more commonly than is realized and can often be diagnosed from the history and physical signs.
2. The most interesting articles dealing with this condition are by Robinson (1900), Conner (1906), Bloodgood (1907), and Codman (1908).
3. Experimentally, it has been shown that animals with an isolated duodenal loop die of a chemical rather than bacterial poisoning.

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4. The obstruction may involve the first or second portions of the duodenum only, due to ulcer, or gastropexy or adhesions; or the entire duodenum, most frequently caused by compression between the vertebral column behind and the superior mesenteric artery in front, especially when there is traction in the direction of the pelvis from the drag of a distended and ptosed cæcum and colon.

5. The physical signs of obstruction in the first portion are those of pyloric obstruction. When the second and third portions are involved it can often be made out by percussion and succussion.

6. X-ray frequently fails to show duodenal obstruction, but may be rendered more effective if a special technic is used.

7. The symptoms are those of epigastric discomfort and toxic manifestations. With a competent pylorus, cramp-like pains predominate, when incompetent, regurgitation of bile is frequent. "Bilious attacks" are probably due to duodenal obstruction.

8. The symptoms are often suggestive of ulcer, gall-bladder, or appendicular trouble, and in operating for these conditions with negative findings the duodenum should be carefully examined.

9. Medical treatment, consisting of abdominal support, nutritious diet and anti-constipation measures, is beneficial in the majority of cases.

10. Surgical treatment in obstruction of the first and second portions consists of freeing of adhesions, gastropexy or duodeno-duodenostomy. In the third portion the procedure of choice is duodeno-jejunostomy.

11. Duodeno-jejunostomy is indicated in (a) vicious circle after gastroenterostomy, (b) accompanying gastroenterostomy when the duodenum is obstructed, (c) in obstruction of the third portion not responding to medical treatment.

12. The total number of duodeno-jejunostomies reported are fifty-eight. There has been no mortality. In the author's series, thirty-six were completely relieved of very troublesome symptoms, four were markedly improved, and only one unimproved.

13. Duodeno-jejunostomy will save from invalidism a group of patients not amenable to other treatment and should be recognized as a definite surgical procedure.

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SYMPHYSIOTOMY AS AN AID TO THE REMOVAL OF CANCER OF THE PROSTATE

A PROPOSED NEW OPERATION

By GEORGE WALKER, M.D.
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ALL operators who have excised cancer of the prostate by Young's perineal method fully realize the difficulties in technic of the operation, as well as the impossibility of carrying out the procedure under direct vision. By experimentation on cadavers I have found that a symphysiotomy or pubiotomy not only greatly facilitates the removal, but also enables the surgeon to see clearly the extent of the diseased process and to do the repair of bladder and urethra with precision. The steps of the operation are as follows:

1. Expose the bladder in the same manner as is done in an ordinary suprapubic operation.
2. Open the bladder to confirm the diagnosis, and to ascertain the extent of the invasion of the vesical neck.
3. Divide the symphysis, pubic ligaments and attachment of the triangular ligament.
4. Abduct the leg slightly; this procedure separates the cut ends of the bone. It will be found that an abduction of about six inches makes a separation of from $1\frac{1}{2}$ to 2 inches.
5. Divide the bladder transversely near the vesical neck. The incision through the wall should be as near the prostate as the growth will allow.
6. After the bladder has been completely divided posteriorly the seminal vesicles will be exposed; these are then ligated and cut.
7. The urethra is now cut across at its junction with the prostate.
8. Separate the prostate carefully from the surrounding structures. Expose the inferior vesical artery and the branch of the superior vesical artery and ligate them. Continue the enucleation until the gland is free, so that it can be removed.
9. Make an opening through the perineum for drainage.
10. Close the posterior three-fourths of the bladder wound leaving a small opening at the anterior angle for the connection of the urethra to the bladder, then suture cut end of the urethra to the opening left in the bladder.
11. Close the symphysis with heavy silver wire.
12. Place the proper drains and close the wound.

The experience of obstetricians is that the bones after pubic pubiotomy quickly unite by fibrous union, and that the patient is able to walk within a comparatively short time. Even if union does not occur, walking is not materially interfered with, since the pubes do not have to carry much weight.

Although I have not as yet had the opportunity of performing this operation on a patient, I am convinced that it is thoroughly practicable and should have a field of great usefulness in excision of malignant tumors of the prostate.

THE SECRETORY PRESSURE OF THE KIDNEY AS AN INDEX OF PATHOLOGIC CONDITIONS

(PRELIMINARY REPORT)

BY GEORGE WALKER, M.D.

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SURGEON, JOHNS HOPKINS HOSPITAL

THE secretory pressure of the kidney has not been determined in man, but in the dog it has been found that with the ureter occluded the intrapelvic pressure increases rapidly up to 40 mm. of mercury, and then more slowly up to 60; at the latter point it ceases to rise, and the secretion of the kidney stops.

The secretory pressure of the kidney is most probably due to osmotic action, and does not depend on the blood-pressure.

It occurred to me that the normal secretory pressure should vary with pathological conditions, and that, if this variation could be determined, it might act as an accurate index of kidney function.

To measure this pressure plus the pressure caused by the contraction of the muscle of the renal pelvis and ureter I have constructed a simple device, which is shown in the accompanying cut.

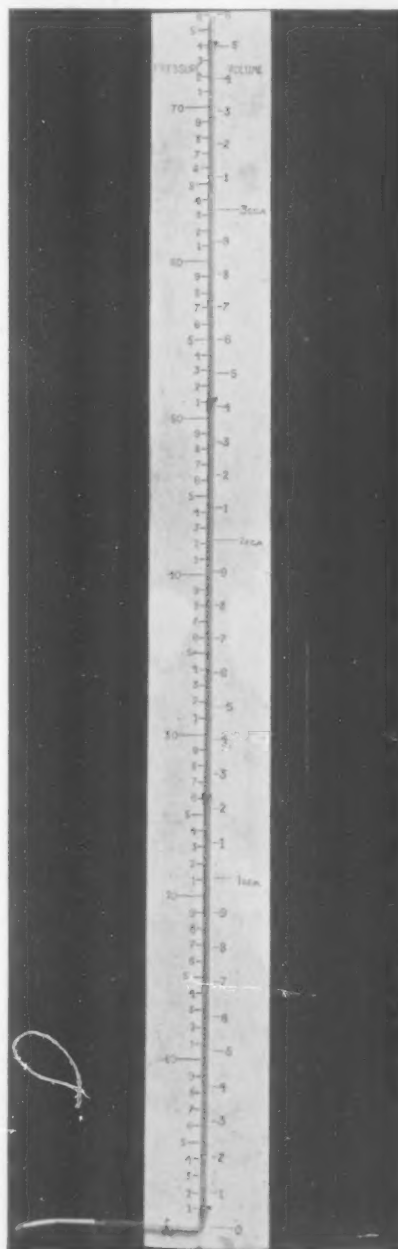
Description of the Apparatus.—The apparatus is made of a small glass tube with an inside diameter of 2 mm. and a length of 1.01 m. It is bent at a right angle at the lower end and fixed to a board 1.03 m. in length and 10.3 cm. in width. The lower end of the tube is drawn to a point, to which a piece of rubber tubing is attached. On the face of the board there are two scales, one for measuring in cubic millimetres the volume of urine secreted, and the other for indicating the intrapelvic pressure in terms of millimetres of mercury. The scale on the volume side was determined by means of a burette, and the pressure scale by a mercury manometer.

Plan of Procedure.—A renal catheter, No. 7 or 8, is introduced into the pelvis of the kidney, or high up into the ureter. It is necessary to employ as large a catheter as can be introduced into the ureter in order to prevent leakage of urine around it into the bladder. After the flow of urine is well established, the exposed end of the catheter is inserted into the rubber tubing connected with the instrument. The apparatus is then held upright and adjusted so that the zero point on the lower end of the scale is approximately on a level with the patient's kidney. I have found that the urine rapidly rises to a certain height and then begins to oscillate and to ascend much more slowly. This point of oscillation is usually reached in about twenty minutes, and is taken as an arbitrary point for reading. In a normal kidney the pressure, according to this, is from thirty-five to forty-five.

In addition to reading the pressure, the amount of each secretion may

THE SECRETORY PRESSURE OF THE KIDNEYS

be measured by the scale on the volume side, and the interval of time between secretions noted. If the catheter is in the ureter, the intervals of



secretion are quite marked, but if it is in the pelvis, the secretion is more constant; even then slight interval rises are to be observed. Both kidneys may be tested simultaneously or separately.

Results.—I have not employed this method sufficiently to make any definite claims for its value, but the results so far obtained indicate that it has a place as an additional means of renal diagnosis. And, theoretically, it may open up a wide field of clinical research, not only in surgical diseases of the kidney, but in all forms of nephritis as well.

There should not be the slightest danger in the use of this procedure, provided it is done in a proper manner and not continued too long. Twenty minutes is long enough to give a reading, and it is not possible that this could cause the least damage. In one instance in which the method was continued for forty-five minutes it produced bleeding, and it is readily conceivable that keeping the catheter in for an hour or longer, under high pressure, might do harm.

Sterilization.—The apparatus is sterilized by filling the tube with bichloride of mercury solution 1:1000 and allowing it to stand for one hour. Care must be taken to see that all of the solution is out of the tube before the apparatus is used.

The following cases have been selected as illustrations:

CASE No. I.—Male, aged thirty-four years. Complained of having passed renal calculi. Complete examination, comprising phenolsulphonaphthalein, X-ray, etc., showed no abnormal condition. Pressure at the end of twenty minutes on right side, forty-three. Pressure at the end of twenty minutes on left side, forty-two. The above is an example of normal kidneys.

CASE No. II.—Male, aged twenty-seven years. Advanced parenchymatous nephritis with double pyelitis. Pressure on right side, twenty-five. Pressure on left side, twelve.

CASE No. III.—Male, aged thirty-two years. Chronic nephritis with pyelitis. Pressure, right side, twenty-seven. Pressure, left side, twenty-five.

CASE No. IV.—Male, aged thirty-six years. Left pyelitis with nephritis of corresponding kidney. Pressure, right side, twenty-nine. Pressure, left side, twelve.

CASE No. V.—Male, aged thirty-two years. Moderate degree of hydronephrosis left side. Pressure, left side, twelve. Pressure, right side, not taken.

CASE No. VI.—Male, aged fifty-eight years. Hydronephrosis on the left side. Pressure, left side, eighteen. Pressure, right side, twenty-nine.

CASE No. VII.—Male, aged thirty-six years. Stricture of lower end of left ureter with mild degree of hydronephrosis. It was impossible to pass a larger catheter than a No. 5 on the affected side and a No. 6 on the sound side. The pressure rose on each side to ten and twelve, respectively, then began to oscillate, and finally fell to six. From the marked oscillation it was clearly evident that the urine was leaking around the catheters, consequently no reading could be obtained.

Clinical investigations and experimental work on animals are being continued and will be reported later. This preliminary report is made hoping that someone who has more diversified material at hand may be interested and will test the method further.

SLIDING HERNIA OF THE URETER

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THE experienced operator will never give credence to the assertion that the surgery of hernias is routine and uninteresting. In diagnosis often supported solely by the patient's conviction, in complications presenting the most spectacular disasters, and in operative findings yielding the most unexpected range of structural pathology, hernias demand and exact the most philosophical and resourceful surgery.

The sliding type of hernia is a not uncommon nor disrespected pitfall of the rapid and confident operator. It has been well said that the incidence of sliding hernias is greater than would be estimated from those reported, for the reason that most surgeons are eager to forget them. The hernia of the ureter under consideration is not easily forgotten, inasmuch as the possibility of its occurrence was unknown to us and to our surgical friends. A study of the literature revealed but a single analogous case, and that one reported very recently.

Briefly, the sliding hernia is a hernia of an organ either totally or in part extraperitoneal, either with or without a sac or partially sacculated, and either associated or unassociated with herniation of intraperitoneal viscera. The great majority are inguinal hernias, but half a dozen femoral sliding hernias having been reported. Judd (*Mayo Clinic Papers*, 1909) recorded 14 sliding hernias in 1653 herniotomies. Davis (*Jour. Amer. Med. Asso.*, August 12, 1916) reported 7 in 1500 herniotomies, while Eccles ("Hernia, Its Etiology, Symptoms and Treatment," 1900) estimated that the bladder "slid" into 1 per cent. of inguinal hernias.

Types of Sliding Hernias.—Moschcowitz (*ANNALS OF SURGERY*, 1914, lix, p. 610) established and elaborated the principles of sliding hernias. He asserted that the greater the uncovered area of an organ the more likely is the organ to become part of a sliding hernia. The ureter, he states, is, or should be, according to this premise, always a component of a sliding hernia. Yet neither Moschcowitz nor any other writer, with a single exception, has spoken of the actual finding of the ureter as an integral part of a sliding hernia. Moschcowitz classifies the following organs as "likely" to form sliding hernias: the ascending and descending colon, the broad ligament, the bladder and the appendix; and as those "rarely" participating the sigmoid, small intestine, uterus and Fallopian tubes.

Moschcowitz further classifies sliding hernias as those created by

"pulling" and those created by "pushing." Those which are "pulled" (ostensibly by the sac and contents of an inguinal hernia) are large hernias with a large sac. Those which are "pushed" (ostensibly by some increase or unequal distribution of intraabdominal pressure) are small hernias usually without a sac. Where the sac exists, the sliding component is found to its outer side and posteriorly.

Excepting possibly the bladder, by far the commonest organ found in the sliding hernia is the cæcum or ascending colon with or without the appendix. All but a few of the sixty-three cases reported by Gibbon (*Jour. Amer. Med. Asso.*, xxxi, 1898, p. 1385) were of the cæcum. Carnett (*ANNALS OF SURGERY*, 1909, xlix, p. 491), in discussing nine cecal hernias, emphasizes the importance of anomalous peritonealization of the cæcum in predisposing to its association with sliding hernias. Incomplete investiture of the cæcum with peritoneum when the latter becomes fused with the mesocolon, or the retention of an unusually long and redundant mesocolon, may threaten it with herniation.

Marshall (*Wisconsin Med. Jour.*, 1914-15, xiii, p. 99) advances a further etiological factor in the formation of cecal hernias. The ligament of the testis, by its intimate attachment to the mesentery of the cæcum, appendix and ileum, is thought to serve as the strand by which the testicle, during its descent, might drag behind it these willing structures. Adhesions are thought to facilitate this defection.

Literature.—Ransohoff (*ANNALS OF SURGERY*, lvi, 1912, p. 313), Rockey (*Northwest Med.*, 1914, vi, p. 294), Walton (*ANNALS OF SURGERY*, January, 1913), Wier (*Med. Rec.*, lvii, 8, February 24, 1900, p. 309), Hotchkiss (*ANNALS OF SURGERY*, l, 2, August, 1919, p. 470), Davis (*Jour. Amer. Med. Asso.*, August 12, 1916), Fiaschi (*Australas. Med. Gaz.*, November 20, 1907), Thornton (*Jour. Iowa Med. Soc.*, 7, 71, February, 1917), Unwin (*Brit. Med. Jour.*, 1915, i, p. 329), McMahan (*Jour. Tenn. Med. Asso.*, 9, 431, March, 1917), and Sprengel (*Arch. Klin. Chir.*, 95, 702) are writers of recent and interesting reports upon sliding hernias. Their cases considered number *in toto* about seventy, and none of them have found the ureter in a sliding hernia.

Historically, the collection by Foerster of fifty-four left-sided cases (*U. of P. Med. Bull.*, December, 1901), by Gibbon of sixty-three cases (*Jour. Amer. Med. Asso.*, xxxi, 1898, p. 1385), by Hildebrand of 139 (*Deut. Zeit. f. Chir.*, 1892, xxxiii, p. 182), and by Baumgartner of 159 cases (*Thèse de Paris*, 1905) present exhaustive studies of the mechanism and components of sliding hernias. None of them record finding the ureter. Baumgartner cites three cases of sliding hernia in which the kidney on the corresponding side was displaced downward several inches, together with the aorta and vena cava, and quotes Tuffier's assertion that a general visceroptosis is a not uncommon sequel of large sliding hernias.

Bennett and Cunningham (*Sectional Anatomy*, 1888), in making sections of a fetus harboring a large cecal hernia, observed that the right

SLIDING HERNIA OF THE URETER

ureter had been dragged forward two inches and occupied a position close to the neck of the sac.

The only case analogous to the one here recorded is that of Griep (*Med. Klin.*, 16:24, June, 1920). In operating upon a large left-sided hernia at the Red Cross Hospital in Kassel he encountered the left ureter prolapsed into the inguinal canal and dilated sufficiently to admit a No. 20 French catheter. The extent of the prolapse was not recorded. The urine was normal and there was no evident etiology.

Protocol of Case.—F. O., a Polish coal miner, aged thirty-three years, was admitted to the University Hospital, Philadelphia, on October 10, 1920. For the past eighteen years he had had a right inguinal hernia which had grown so large as to cause some disability but no discomfort or pain. The previous history was negative save for smallpox in childhood.

The patient complained of nothing except the hernia. After the operation it was determined with the aid of an interpreter that for the preceding two years the patient had some frequency of urination during the day, voiding about every two hours. There was no two-stage micturition occasionally met with in hernia of the bladder.

Physically, the patient presented no abnormalities save indistinct pock-marks about the face and neck, and a very large right scrotal inguinal hernia. When the patient stood, the scrotum reached half way to the knee, and its dimensions were about those of a football. The hernia was easily reducible through an enormously dilated inguinal canal. The testicle occupied the most dependent portion of the scrotum, and the contents of the sac yielded a resonant note throughout.

Blood-pressure, 140-85; the blood-count normal; phthalein elimination, 45 per cent. in two hours and ten minutes.

Operation (October 11, 1920).—Doctor George G. Ross exposed the sac in the usual manner and freed it without difficulty from its attachment to the bottom of the scrotum. The sac was about seven inches long, three inches in diameter and one-eighth inch in thickness.

The sac was opened, and its contents, composed entirely of small intestine, reduced without difficulty. The sac was then separated from surrounding structures in the neighborhood of the internal ring. A protrusion about the size of a golf ball was noted immediately to the outer side of the neck of the sac. It was thought to be a part of the sac or a second sac, since it had the same tough, thick appearance, and was accordingly incised. Urine of ammoniacal odor immediately welled out. Thinking that a very large diverticulum of the bladder had been opened (although it lay to the outer side of the sac) a sound was passed per urethra into the bladder. The finger in the supposed diverticulum was unable to palpate the sound in the bladder. Dissection proceeded, and it became evident that the ureter was dealt with. It descended to the depths of the scrotum in a single loop and returned to its insertion

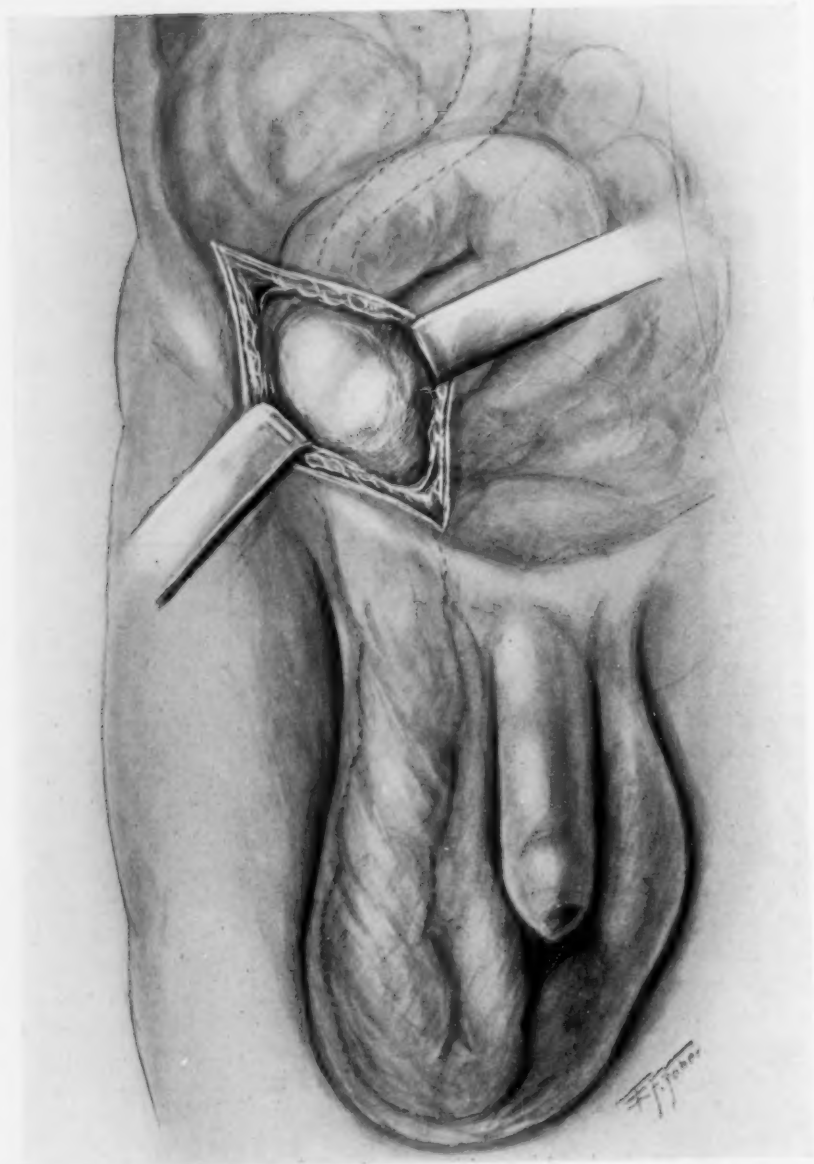


FIG. 1.—Hernial sac exposed.

in the bladder, which was not implicated. About ten inches of extraabdominal ureter was thus dissected with difficulty from the peritoneum forming the posterior wall of the sac, to which it cleaved tenaciously. The ureter was about one inch in diameter and its wall was about one-eighth inch thick.

Since the ureter had been jeopardized by this dissection it was deemed necessary to remove the kidney, and this was speedily done by continuing the inguinal incision upward into the right loin. The pelvis of the kidney was distended to about three times its normal size, and the kidney itself was displaced downward about one and one-half inches and appeared hard and atrophic. The entire ureter was removed with the kidney, its lower end being tied near the bladder. The muscles and fasciæ were closed in layers, a cigarette drain provided for the loin, and an indwelling catheter for the bladder. Hypodermoclysis caused prompt rally from a moderate shock. Convalescence was marked by a severe bronchitis, an orchitis, cystitis, and limited infection of the wound. The latter cleared under Dakin's treatment, while the bladder condition improved with mercurochrome instillations. There was no urethral or prostatic obstruction.

Six weeks after operation patient was discharged with a phthalein output of 40 per cent., no evidence of recurrence of hernia, and in good general condition. Unfortunately, the patient refused cystoscopic examination.

Discussion.—This case is of particular interest not so much for its presenting a sliding hernia of the ureter, but for its presenting a sliding hernia of the ureter alone. How is it possible to explain the failure of the cæcum, ascending colon or other organs to take part in the "sliding" feature of the mechanism? If a hernia of such size was able to "pull down" the ureter, according to the theory of Moschcowitz, why should it not have pulled down other adjacent extraperitoneal organs?

It is believed that these questions can only be answered by classifying this hernia as a congenital anomaly.

According to Piersol ("Human Anatomy," Lippincott, Philadelphia), the genito-inguinal ligament by means of which the testicle descends into the scrotum, is attached to the ligament of the testis through the intermediary of the Wolffian duct. The ureter, which develops as a stalk from the Wolffian duct during the fourth week of fetal life, lies anteriorly and to the outer side of the Wolffian duct and the two ligaments guiding the descent of the testicle. It is, therefore, in a position to be dragged down with these structures should differentiation fail to occur early enough, or should it adhere to them.

The Wolffian duct at a later period becomes drawn down to form the epididymis, vas deferens, and seminal vesicle. The ureter has occasionally been observed to have been drawn down also and to terminate in the vas deferens or the seminal vesicle (Piersol).

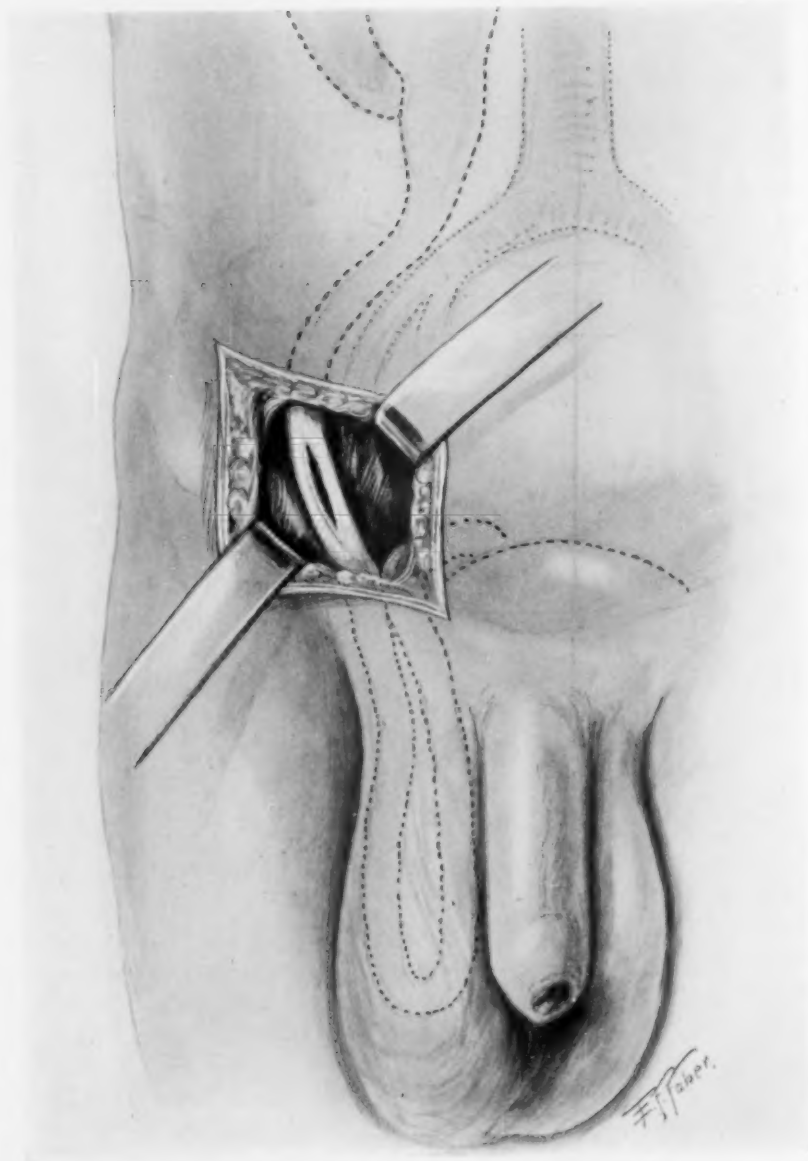


FIG. 2.—Sac and contents removed. Ureter in position.

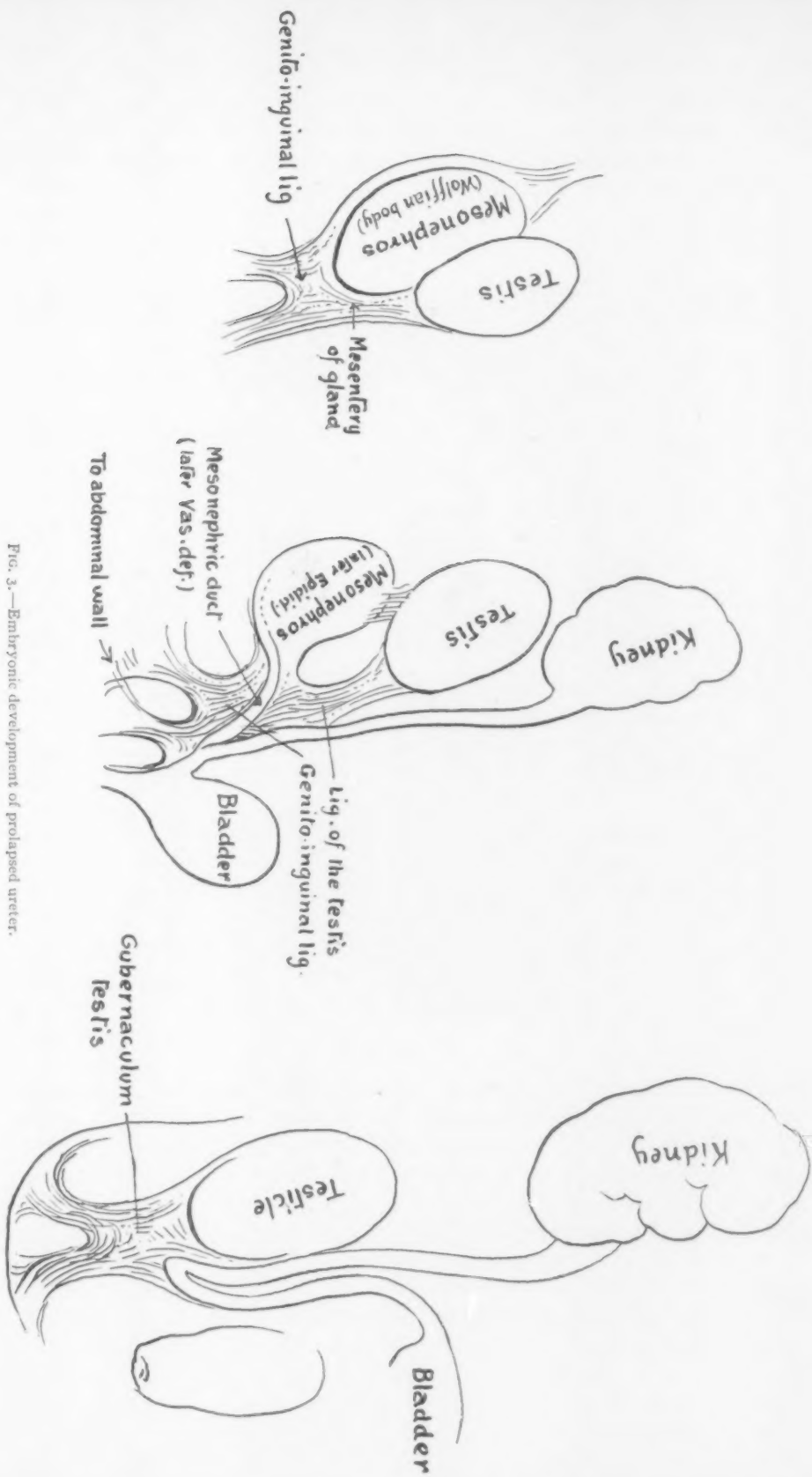


FIG. 3.—Embryonic development of prolapsed ureter.

If this speculation is acceptable, it furnishes evidence in the moot question as to the congenital or acquired nature of all hernial sacs.

The interesting observation of MacLellan (*Surg., Gyn. and Obstet.*, 29, 387, October, 1919) lends additional support to the theory of congenital development. MacLellan found undisputed adrenal rests imbedded in the sacs of six hernias in a series of 700 consecutive hernio-



FIG. 4.—Specimen removed.

tomies in children. These small accessory suprarenals are thought to arise from the atrophic tubules of the Wolffian body (Piersol). It is not unreasonable to suppose that a structure so closely related as the primitive ureter might travel as far and as promiscuously.

CONCLUSIONS

1. A second case of prolapse of the ureter through the inguinal canal is reported.
2. The evidence presented favors the theory of congenital formation of hernial sacs.

DISLOCATIONS OF THE SEMILUNAR CARPAL BONE

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AN apology should be made probably for reporting one case of any kind. If the report of that case stimulates an interest in the subject, and a careful study of future cases of similar injuries prove that the present experience is erroneous in that the type is not as rare as we think it is, the report will have served a good purpose. Such is the hope of this contribution.

During the past ten years at the Surgical Clinic at Touro Infirmary, we have seen only one *uncomplicated* case of *dislocation* of the semilunar carpal bone. This may be due to one of several factors.

Dislocations of the carpal bones probably will always form a small part of the experience of the individual, as has proved the case in our experience, but since they must be considered in all injuries of the wrist, the possibility must be borne in mind.

Stimson in his classic work states that "the X-rays have shown that dislocation of the semilunar bone, either alone or in combination with fracture of the scaphoid, is far from uncommon and is second in frequency to fractures of the scaphoid." He further states: "Of each of these there are many clear uncomplicated cases."

One of the most frequent types of cases which we are called on to treat is injuries to the wrist. Fractures of the base of the radius form by far the greatest number of these cases, but in making the examination it is necessary to bear in mind the many other conditions which might result from the violence. Each in turn must be eliminated. Each type requires its special treatment. In the near future an analysis of our experiences with wrist injuries will be published.

Among the possible conditions to be considered it is necessary to give attention to "sprains," traumatic tenosynovitis, fracture or dislocations of the carpal bones, individually or collectively. The possible injuries to the wrist can only be eliminated by a systematic examination, which takes into account the anatomic landmarks as well as the probable reason for each symptom and sign which is evident.

The casual examination upon which a diagnosis of sprain is made cannot be justified in the light of properly interpreted X-ray pictures nor by the disabling results which follow in their wake. Reference to clinical experience and to the work of Ross and Stewart on Sprains Fractures will convince the most sceptical of the infrequency of true sprains. They tabulated in 1911 the results of observations of 145 cases; twenty-five involved the wrist. Of the twenty-five, seven proved to be

cases of old "sprain fracture of the scaphoid, one case of fracture of the os magnum, one of fracture of the lower end of the radius, scaphoid and semilunar in the same wrist. There is not one of the semilunar alone." *"All of these cases suffered as a result of either being treated as a sprain or receiving no treatment."*

These authors performed a series of fifteen experiments on animals in which a pulling force, hyperextension and forces in other directions was placed on joints in such a way as to increase the range of motion beyond the normal. In every instance save one the bone gave way. The tendons

and ligaments remained intact in most instances. They concluded: "These experiments show how the frequent occurrence of sprain fractures is possible and how rupture of tendons and ligament as a part of the pathology of so-called sprains is impossible."

The experience which has been obtained during the past ten years at the clinic has confirmed these observations of Ross and Stewart. *Taking all joints into consideration where a careful physical examination as well as an X-ray examination was made, we have found very few instances where there was not more*



FIG. 1 (19514).—Dislocated semilunar carpal.

to explain the disability than an unseen but simply suspected tear of ligaments. Of course, for a time, until the patient ceases to feel that pain is part of his misfortune, he will be pacified. When the pain persists he wants to know why. It will be necessary to explain unless one avoids the diagnosis of sprain behind which to hide.

There may be some who will say that in cases where there is no disturbance of anatomic landmarks, with only pain and some swelling, a sprain will be sufficient diagnosis. They are too easily satisfied. The pain which follows an injury is associated with limitation of motion, which is nature's defensive mechanism, the production of muscular con-

DISLOCATIONS OF THE SEMILUNAR CARPAL BONE

traction. Would it not seem more plausible to believe that the immediate swelling about a joint is the result of an outpouring of synovial fluid in the joint as well as in the tendon sheaths? Therefore one would expect and does actually find frequently in these injuries about the wrist, in which the landmarks are intact and in which radiologic examination is negative, that there is a localized swelling just below the base of the radius and that the pain accompanying these injuries is exaggerated by palmar flexion. Traumatic tenosynovitis is not a rare occurrence and justifies its proper treatment, which consists in immobilization of the forearm and wrist, with the wrist in dorsiflexion.

In 1917 I discussed the subject of sprains in *The New Orleans Medical and Surgical Journal*, vol. lxi, No. 9. The conclusions arrived at at that time have been confirmed by increased experience.

Before proceeding with a discussion of the possible injuries of the wrist, let us briefly review the anatomy of this joint. "Piersol's Anatomy" has been largely drawn upon for this purpose.

The capsular ligament, which is subdivided into the external lateral, internal lateral, anterior and posterior ligaments extends from the base of the radius and styloid of the ulna down to the level of the metacarpals. Within this capsule are three articulations—the radiocarpal, intracarpal, and carpo-metacarpal. The lower end of the radius articulates with the scaphoid and semilunar. These two bones occupy almost completely the articular portion of the base of the radius. It must be remembered that the lower end of the radius presents an overhanging lip or ridge which limits dorsiflexion of the wrist. *It must be remembered, particularly when we are considering injuries to the wrist, that limitation of palmar and dorsiflexion is due to some mechanical alteration of the normal relationship of the carpal bone and the base of the radius.* The displacement of any one of

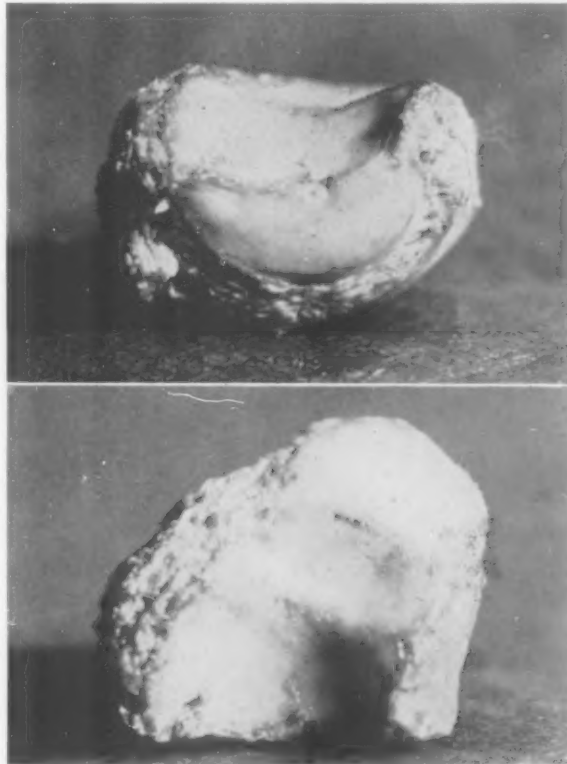


FIG. 2 —The removed carpal bone.

these, due either to fracture or a dislocation of one of the carpals, or a fracture of the base of the radius, with a displacement of the base of the radius causing a change in the axis of the lower fragment, will interfere with normal motion in palmar and dorsiflexion. From the foregoing we are reminded that such limitation of motion is suggestive of more than a simple sprain. *We should be on the alert* for the possible mechanical causes of such limitation.

The carpal bones of the first row are united by interosseous ligaments. A synovial membrane covering the carpo-radial joint, which extends over



FIG. 3.—Result after removal of semilunar carpal bone.

the proximal ends of the first row, shuts off this joint from the intracarpal joint. The scaphoid is attached to the semilunar much less tightly than is the cuneiform, so that there is considerable motion between the scaphoid and the semilunar. The scaphoid, besides sliding in various directions on the semilunar, can move to some degree independent of the rest of the first row. The scaphoid, semilunar, and the cuneiform have been compared to a meniscus subdividing the joint. No muscle of the forearm is inserted into them.

These bones are never moved directly, but change their position

under pressure of the distal row, which is pulled against it by the muscles moving them (Piersol). The greatest number of wrist injuries result from a fall on the outstretched hand. The exaggerated dorsiflexion which results causes a stretching of the anterior portion of the capsule of the wrist, as well as an impaction of the scaphoid and semilunar against the base of the radius. This latter effect is due to the weight of the body acting through the base of the radius, being transmitted thereby to the semilunar and scaphoid. The resistance is furnished by the trapezoid, trapezium, and os magnum.

DISLOCATIONS OF THE SEMILUNAR CARPAL BONE

Experiment and clinical observations have shown that the ligaments do not tear independent of the bony prominences; therefore fracture of the base of the radius is the most frequent injury. The mechanism of this injury has been clearly described by Dr. Lewis Stephen Pilcher in a recent monograph. Reference to this will be profitable.

The question often arises, why the comparative infrequency of dislocations? Aside from the strong ligamentous attachments it would seem that the overhanging lip of the radius is the most important agent which prevent such an accident. Dislocation of a carpal bone is associated with a deformity, which is at times not easy to differentiate from fracture of the base of the radius.

It is always necessary to consider anatomic landmarks about the wrist when making an examination. Normally we expect to find the styloid of the radius on a lower plane than the styloid of the ulna. If the styloid of the radius rises to the level of the ulna styloid it may be definitely stated that there is a fracture of the base of the radius, with an upward displacement of the distal fragment, or impaction of the shaft into the distal fragments. There is usually



FIG. 4.—Result after removal of semilunar carpal bone.

a lateral deviation of the hand to the radial side, with a corresponding prominence of the ulna styloid. The limitation of function, particularly palmar and dorsiflexion, is marked. In this last-named sign there is a marked similarity between a dislocation of the carpal semilunar and fracture of the base of the radius. The limitation of function in the former is due to a mechanical interference, the presence of the dislocated bone in front of the articular surface of the radius. The fact that dislocations of the semilunar carpal result from forcible dorsiflexion (as cranking an automobile) makes it imperative to subject to radiographic examinations injuries other than, and as well as, injuries resulting in deformities of the wrist.

The diagnosis probably cannot be made with certainty without the aid of properly taken radiograms.

The one thing which can be said after finding that the prominences bear their normal relationship to each other is that there must be a mechanical interference such as would be caused by the dislocation or fractured carpal bone.

In regard to the value of the X-ray one must consider the peculiarities which carpal bones may present; pictures must be taken in several planes. Stereoscopic radiograms will probably be of great service.



FIG. 5.—Result after removal of semilunar carpal bone.

Dislocations here like in other locations are either recent or ancient.

In arriving at a decision to adopt a particular type of treatment we should be guided by certain principles: (1) Can we completely reduce the dislocated bone: thereby restoring the normal functions? (2) If reduction cannot be effected by manipulation, will removal permanently interfere with the function of the joint?

In recent cases at times it is possible by manipulation to reduce the dislocation.

This was well illustrated in a recent experience. The patient had a fracture of the scaphoid, with incomplete dislocation

of one of the fragments, and under an anæsthetic the wrist was manipulated and reduction was effected.

In old unreduced dislocations it is highly probable that reduction cannot be effected. The space normally occupied by the dislocated bone probably becomes more or less filled by tissue of new formation or the remaining carpal bones become more closely approximated, preventing complete reduction. Incomplete reduction will result in permanent limitation of motion.

If the function of the first row of the carpal bones is as Piersol has

DISLOCATIONS OF THE SEMILUNAR CARPAL BONE

suggested, that of a meniscus, the same treatment can be applied here as in a dislocated cartilage in the knee—that is, removal.

Good function is restored after removal, as will be shown by the accompanying photographs of the case herein reported; therefore, it would seem that surgical removal is the only logical procedure.

The method of approach to the carpal bones offers many difficulties, if one would avoid injury to important structures. The incision used in the case reported here was that suggested by Dr. James Thompson, of Galveston, for exposing the lower end of the radius. A linear incision beginning at the radial styloid and extending upward for about two inches, the supinator longus was retracted to the radial side; radial artery and nerve were retracted with the superficial flexors to the ulna side; the pronator quadratus was exposed, after which the anterior carpo-radial ligament was incised, thus exposing the first row of carpal bones. The dislocated semilunar came readily into view. The deep flexor tendons were seen superimposed on the dislocated carpal bone. By cutting the interosseous ligament the semilunar was mobilized completely and removed. The wound was closed without drainage and the patient encouraged to move the hand as soon as he roused from the anæsthetic.

The principle of immediate mobilization of joints, which was suggested by Willems, and which has been hailed as the most valuable contribution to the surgery of joints in recent years, is applicable here.

CASE I.—J. P. T., male, aged forty-four years, laborer. Twelve weeks ago, while cranking a Ford automobile, the engine backfired, and as a result of this his wrist was injured. He was unconscious for a few minutes, and when consciousness returned he sought the service of a doctor, who believing it to be a fracture of the base of the radius manipulated and put on splints, which he allowed to remain on for several weeks. The pain in the wrist persisted, and even after the dressing was removed by the doctor, there was marked limitation of motion in the wrist and fingers. At the present time his chief complaint is pain in the wrist and fingers, and inability to flex the wrist or make a fist.

Examination.—There is a slight enlargement of the right wrist as compared with the left, and a distinct prominence on the palmar side of the wrist. This prominence is hard, there is a normal lateral mobility at the wrist, but flexion is limited to about 10 degrees; dorsiflexion is less limited than palmar flexion; he has almost complete loss of grip; there is a glossiness of fingers, and atrophy of the muscles of the hand and fingers. The intraphalangeal joints of all the fingers have very little motion. X-ray was requested, because it was thought that the patient was suffering from an impacted fracture of the base of the radius. The X-ray, however, showed very clearly a dislocation of the semilunar carpal bone. The patient was advised to be operated; this advice was accepted, and he was operated at the Flint Goodridge Hospital by Dr. Isidore Cohn, assisted by Dr. Paul G. Lacroix. The details of

the operation having been described in the first part of the paper it is unnecessary to repeat them. The X-ray photograph of the removed carpal bone and photographs of the patient at the present time accompany the paper.

Present condition of the patient is as follows: The contour of the wrist is practically normal; there is only a slight limitation of palmar flexion; his grip has returned, there is very much glossiness, and as a result of the use of the hand there seems to be a gradual return of the normal appearance of the hand and fingers.

SUMMARY

1. Careful examination will reveal that dislocations and fractures of the carpal bones are more frequent than present records indicate.
2. Limitation of palmar flexion is due to mechanical interference, caused by fractures or dislocations of carpal bones or fracture of the base of the radius.
3. Recent dislocations of carpal bones can be reduced by manipulation.
4. Old unreduced cases had best be operated, with removal of the dislocated bone.
5. Removal of the semilunar causes an interference with good function at the wrist.
6. The approach should be made in such a way as to do as little damage to important structures as possible.
7. Immediate mobilization of the joint is advisable.

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INJURY TO THE BILE DUCTS AND METHODS OF REPAIR*

By HORATIO B. SWEETSER, M.D.

OF MINNEAPOLIS, MINN.

INTERFERENCE with the normal flow of bile into the intestine is one of the most serious mishaps which may befall a patient. This is so, because, on the one hand, if the normal flow is not reestablished the patient will more or less quickly die, and, on the other, the successful accomplishment of the proper return flow is extremely difficult and sometimes practically impossible.

Leaving out cases due to obstruction by pressure of malignant tumors, this interference with the normal flow of bile is due (1) to a stenosis of the ducts following deep ulceration, (2) pressure by adhesions, and (3) division of the common duct (intentional or accidental) during the operation of cholecystectomy.

That such accidents are not uncommon may be inferred from the number of cases reported in which reconstruction has been attempted. It is fair to assume that there must be very many unreported cases, for it is a well-recognized fact that none of us is prone to publish his disasters, especially if they seem due to his own errors of technic. It is also fairly certain that many such accidents will occur in the future, probably many more than in the past, due to the fact that cholecystectomy is largely supplanting cholecystostomy as the popular operation for gall-bladder disorders. It is, therefore, of extreme importance that all cases of attempted repair should be reported, the unsuccessful as well as the successful ones, so that a satisfactory and efficient technic may be developed for their repair. Eliot,¹ in an exhaustive analysis of the cases of stenosis and the methods of reconstruction, collected 190 cases, forty-five being from the Mayo clinic. Since then, now over three years, I have been able to find the reports of only three additional cases. Eliot's report shows that this accident has occurred more than once in the hands of the most skilful and experienced surgeons; and this is not to be wondered at when one considers the difficult pathology and especially the abnormal anatomy often encountered in the right hypochondriac region. Eisendrath,² in a well-illustrated article, has called attention to the anatomical abnormalities of the bile ducts and hepatic and cystic arteries (Fig. 1). In twenty-five of the hundred cases examined, the relationship of the cystic to the hepatic and common ducts was different from that given in the text-books; in seventeen the hepatic and cystic ducts were parallel and closely bound together. Behrend,³ also, published a similar article, laying particular stress on the presence of abnormal adhesions, congenital and acquired.

It is of great importance, therefore, if we wish to keep out of trouble,

* Read before the Hennepin County Medical Society, Minneapolis, Minn., September 7, 1920, and the West Wisconsin District Medical Society, Eau Claire, Wis., November 10, 1920.

always to bear in mind the possibility of the presence of such abnormalities when operating in this area. In one of the two cases herewith reported, the cystic and common ducts were parallel and bound together, both being cut across under the impression that I was dealing only with the cystic duct. This case is of no value as regards method of reconstruction, as the patient died in less than seventy-two hours from septic peritonitis. In the second case the stenosis was not complete and was due to an inflammation of the common duct, which was present before the operation, and made worse, I think, by the presence of the drainage tube.

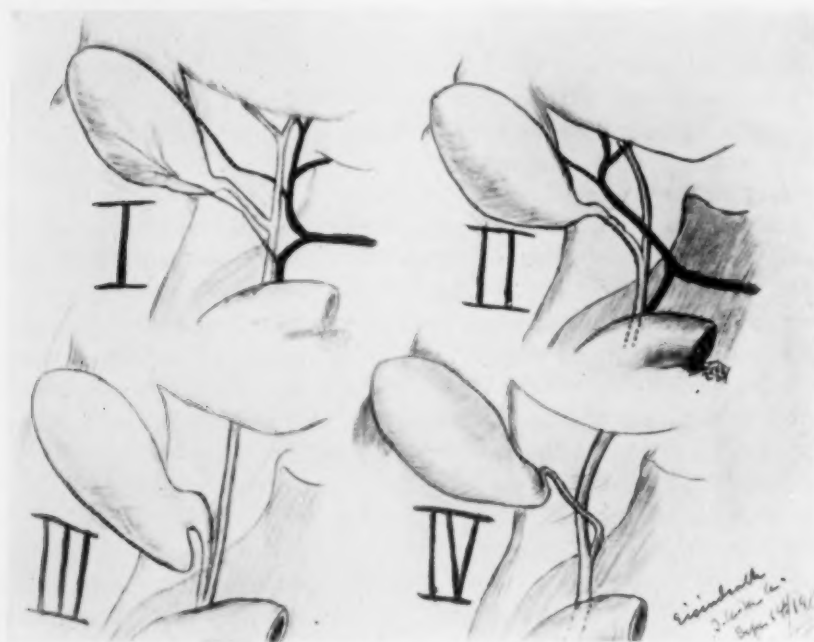


FIG. 1.—Anomalies of the bile ducts and blood-vessels. (Copied from Eisendrath, *Jour. Amer. Med. Assoc.*, vol. lxxi, September 14, 1918, pp. 864-866.)

CASE I.—Mrs. L., aged forty-eight years, married, admitted to the hospital August 29, 1916. For five years she had suffered from repeated attacks of gall-stone colic. The present attack began suddenly and she has since continued sick. When admitted she was jaundiced, urine very dark and scanty, passing only 10 oz. in the first twenty-four hours. Stools were light brown, vomiting persistent, loss of flesh considerable. After a week her condition improved so much that it was considered safe to operate. The very serious mistake was made of attempting to do more than removal of the stones with drainage, for the difficulties we got into prolonged the operation unduly and contaminated the peritoneum widely. At the operation many dense adhesions were encountered before the ducts were exposed. After the gall-bladder was removed, stones were discovered and removed from the hepatic ducts. The hepatic and common ducts were united behind and a tube put in for

INJURY TO BILE DUCTS

drainage. Bile flowed freely from the wound, but the patient complained of great pain, and after twenty-four hours developed symptoms of sepsis with continuous vomiting, increasing pulse-rate and fever, and died in about sixty hours. No autopsy.

CASE II.—Mrs. C. E. T., admitted January 23, 1918, and referred by Dr. Oscar Oberg, Sioux Rapids, Iowa. Thirty-six years of age, married twelve years, never pregnant. Menses began at eleven years. Family history: Both parents died of cancer—father at sixty five, mother at fifty—but her brothers and sisters are all living and in good health.

Personal History.—The only acute illnesses she has had were measles and whooping cough when a child. For the past eight years she has suffered more or less with attacks of gastric disturbance, and during the past two years these have been accompanied with pain, starting in the right epigastrium and radiating to the back and right shoulder blade. A year ago she was jaundiced following an attack, and a few months ago a soreness developed in the right epigastrium which lasted for several weeks but gradually disappeared. Since then she has lost fifty pounds in weight. The present attack began six days ago with severe pain and continuous vomiting lasting for several hours and requiring a hypodermic of morphine. The following day jaundice appeared with clay-colored stools and bile-stained urine.

Examination.—Fairly stout; mildly jaundiced; tender over gall-bladder, greater curvature of stomach and appendix. Skiagram was negative as to gall-stones, but no other comment was made as to the X-ray findings.

First Operation.—On January 26, 1918, the gall-bladder was removed and drainage tube sewed in cystic duct. The bladder was small with very thick walls, and adherent to stomach and duodenum. It contained many stones, one encysted in a pocket in the antrum, and one in the cystic duct, but no bile. No mention is made of probe being passed through duct to duodenum. Examination of specimen showed no evidence that the common duct had been injured. Following operation the flow of bile was profuse. The tube was removed on the ninth day, but the fistula continued to run, and a note made on the twenty-fifth day, February 20th, when she left the hospital, stated that the flow was profuse. On the twenty-first day the stool was noted as highly colored, but when she left it was clay colored. The fistula remained open for two months, to March 25th, its closure being promptly followed by severe pain and some jaundice. After two days it reopened with relief of symptoms, and continued to drain for five weeks, to April 28th, when it again closed and stayed closed up to the time of the second operation. On May 4, 1918, her doctor wrote that the drainage was very slight, that "there was plenty of bile in the stools, and that she was much better." For three weeks following the closure the skin remained clear, but then the jaundice returned and persisted in varying degree. Her appetite, however, was good and food did not distress her. The gall-bladder area ached and was tender, but there was no pronounced pain at any time.

Patient returned to hospital November 30, 1918. At that time the

skin and conjunctivæ were quite yellow in color, but the stools were brown and showed bile reaction to laboratory test.

Second Operation.—December 9, 1918, the abdomen was opened through the old scar. The stomach, duodenum and omentum were strongly adherent to the parietal peritoneum and to the liver, and the adhesions were most dense in the depth of the wound, where eventu-

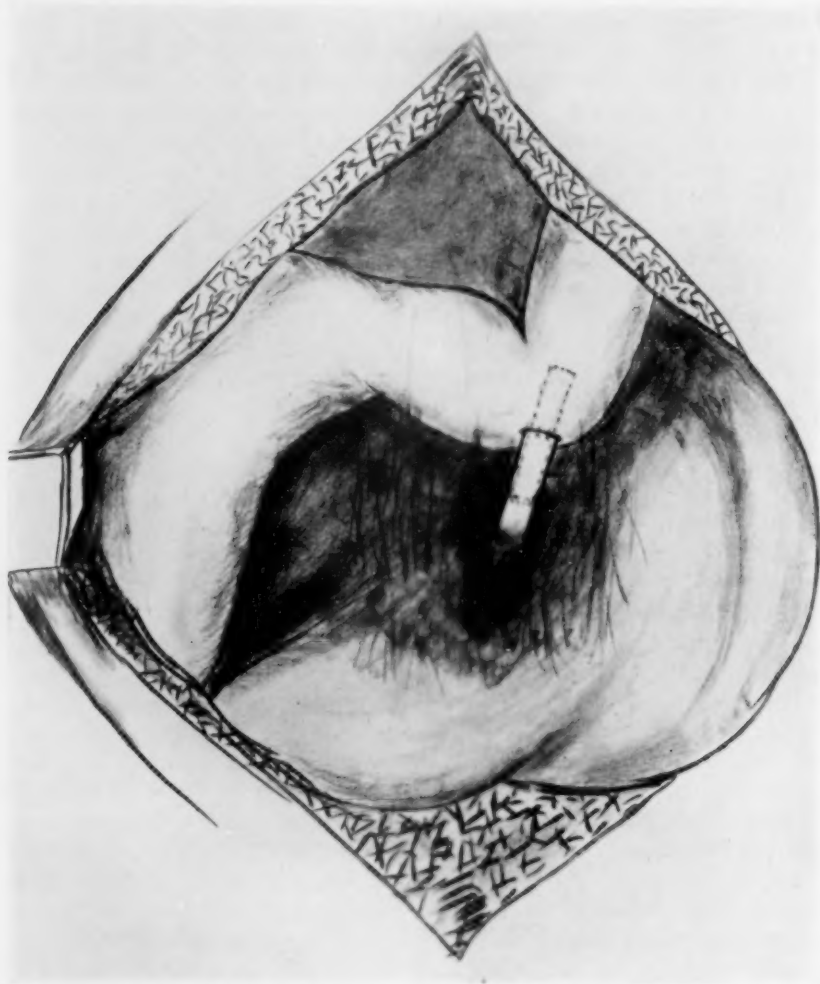


FIG. 2.—Stump of duct freed from adhesions. Duodenum below.

ally the cystic duct was found. A probe passed readily upward, but could not be passed downward to the duodenum. The foramen of Winslow was open, the common duct was not dilated and was not identified. This dissection consumed much time, and the patient was feeling the effects of the prolonged operation. Therefore, and because the presence of bile in the stools showed that the common duct was not entirely closed, it was decided to put a drain in the duct and close the wound to

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it, in the hope that the release of the dense adhesions might allow of further opening of the duct. Patient reacted well and passed brown stools for ten days. However, on the sixth post-operative day there suddenly developed pain, vomiting, fever, rapid pulse, and marked tympanites which continued for four days, and which were relieved by repeated doses of pituitrin. The leucocyte count was 31,000, but no

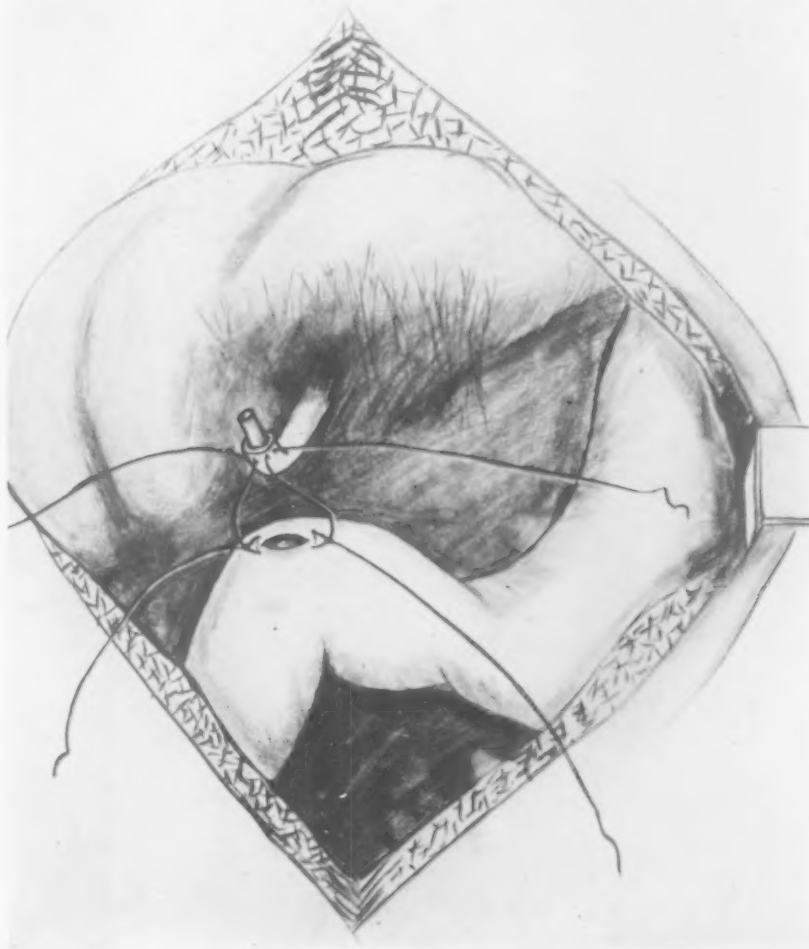


FIG. 3.—Duct containing rubber tube; opening in duodenum; sutures placed.

abscess formed. Her condition then gradually improved, she was out of bed on the eighteenth day, and left the hospital in fairly good condition on January 26, 1919, seven weeks after operation. But the stools contained no bile, and the fistula was draining freely. Closure of the fistula in the latter part of April was promptly followed by discomfort and jaundice. She returned to the hospital for the third time on April 29, 1919. At this time she was moderately jaundiced, but the tempera-

ture was normal, pulse-rate 60 to 80, and she had gained in weight and strength. The urine contained much bile, and the stools were clay colored. Fistula was closed.

Third Operation.—May 1, 1919, incision was medial to the old scar. The same dense adhesions were encountered as at the second operation, and had to be dissected free with knife and scissors. This was a difficult and slow process and quite disconcerting. Finally the cystic duct

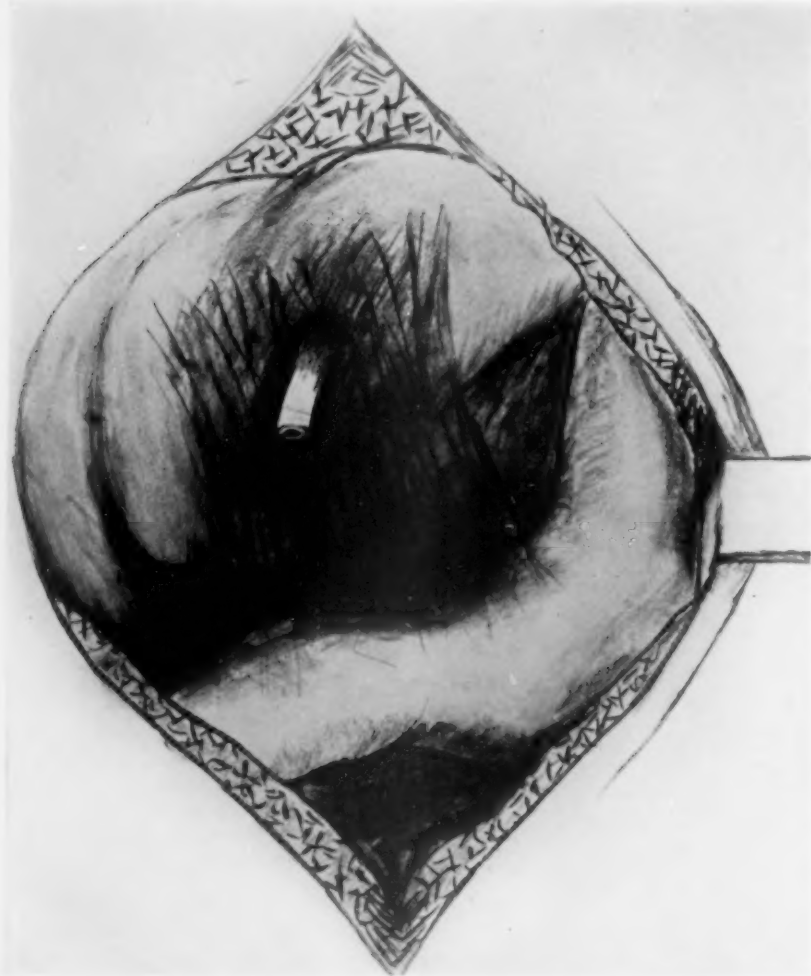


FIG. 4.—Anastomosis completed; rubber tube indicated by dotted line.

was found by the flow of bile and was freed to the extent of about a quarter of an inch. It emerged from the under surface of the liver, and was about the size of an ordinary lead pencil. No effort was made to identify the common duct, and it was not seen at all. The duodenum was mobilized so that it could be easily approximated to the duct. Two linen stitches were then passed through the duodenum one-quarter of an

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inch apart, and tied. A Number 17 catheter was passed an inch into the duct and held in place by a chromic gut suture. The duodenum was then opened between the stay stitches, directly through all coats, no effort being made to form a valve. The other end of the tube, about two inches long, was inserted into the duodenal opening. The stay stitches were then passed through the posterior wall of the duct, the duct and duodenal opening closely approximated, and the stay stitches tied to each other over the tube. The posterior edge of the duct was not sutured to the duodenal opening, but in front the two were sutured. The omentum was tucked around the joint, but not sutured. Rubber dam drains were carried down on either side of the anastomosis, and the abdomen closed. Time was two hours (Figs. 2, 3, and 4).

The following day the patient passed a normal-colored stool. There was considerable oozing from the wound, but a note on the fourth day recorded "a very slight amount of bile discharged from the wound, dark brown stools, and diminishing jaundice." On the seventh day urine contained only faint trace of bile; on this day also the stitches were removed to release a considerable amount of pus. During the eighth, ninth, and tenth days there was considerable discharge of bile, which, however, ceased on the twelfth day. Wound was practically healed at the end of three weeks, May 22nd, when the patient left the hospital. The tube was passed with stool on the fourteenth day. During the past winter she had a spell of sickness, and somewhat jaundiced, but this quickly passed away. A letter received from her physician in June, 1920, stated that she was in the very best of health, was taking long auto drives, could, and did, dance for four hours, and was able to eat a heavy-course dinner without the slightest discomfort; that there had been no return of the jaundice and that her stools were normal in every respect. A recent letter in August, 1920, stated that she has continued in the same condition of good health.

The methods devised for restoring the bile stream to the intestine have varied in order to meet the conditions encountered. Thus, if the common or hepatic duct is cut and the injury immediately discovered, it may be possible to approximate the divided ends of the duct successfully. This has been done a number of times, but some of the cases, successful at first, have failed later, because of stenosis at the point of union (twenty-three cases, four failures).

But in most cases the ends of the ducts are widely separated and the intervening space filled with dense scar tissue, so that such approximation is no longer possible; and then some other means must be employed to bridge the hiatus. The tissues which lend themselves best to a successful and permanent anastomosis are those which normally are bathed in bile, and consequently are immune to irritation by it. Such tissues are the mucous membrane of the ducts themselves and also the mucous membrane of the duodenum, jejunum and stomach. When it has been possible to approximate successfully these structures to the proximal end of the duct, the results have been permanent in

the majority of cases. The failures have been due either to stenosis at the point of union, or to an ascending cholangitis and abscesses of the liver from entrance of bowel contents into the ducts of the liver. To prevent this, in most cases the attempt has been made to form a valve at the point of anastomosis. If there is even only a very small stump of proximal duct, I think it will be found possible in almost every case to approximate either the duodenum, jejunum, or stomach to it so as to make a successful anastomosis. It was formerly thought that the stomach would not tolerate bile in any amount, but practical experience has proved this to be not so. In my case it was very easy to mobilize the duodenum. In several cases a flap from the stomach or duodenum has been used to form a new duct⁴ (Fig. 5), but such attempts require a nicety of technic and a prolongation of an already long operation in patients not likely to be good risks, and I fear would fail with most of us.

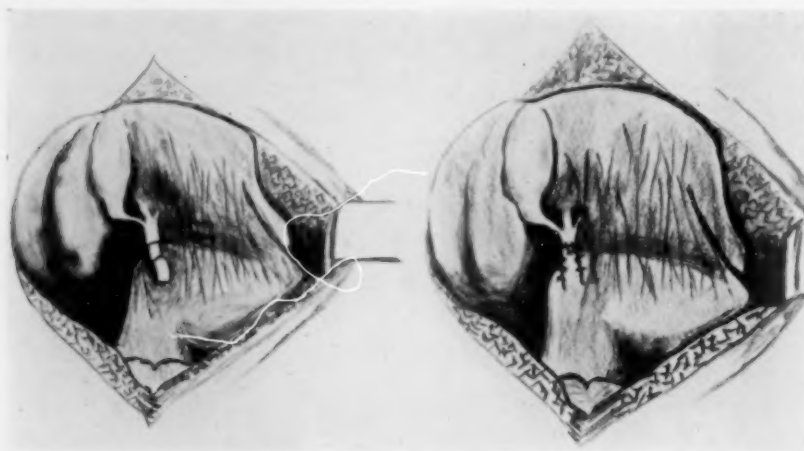


FIG. 5.—Flap taken from duodenum to form new bile duct. (Copied from Walton. *Surg. Gyn. and Obst.*, vol. xxi, September, 1914, p. 271.)

In all cases the anastomosis is made much easier if a temporary rubber tube is used as a splint, to be discharged later through the bowel.

But in a certain number of the cases it has apparently been impossible to approximate any part of the stomach or duodenum to the stump of the duct, and in these a number of ingenious methods have been devised to bridge the gap.

(a) The most successful of these has been the employment of a rubber tube, that portion of it occupying the gap being covered either by the contiguous peritoneum or by the omentum. This method was devised by A. G. Sullivan, in 1900,⁵ and he reported eight successful experiments on dogs, in which the tube was employed to bridge the gap between the duct and the duodenum. By 1912, twenty-two cases by this method were reported, and since then many more. There have been a number of successes, some of them apparently permanent, but many have eventually failed, either from stenosis or from an ascending cholangitis. Jenckel,⁶ of Heidelberg, bridged a gap of

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eight centimetres, the patient being well at the end of four years. Mann,⁷ of our own society, reported a case in 1914, and I understand that this patient is still well. Since 1918 only three cases have been reported: one by Hagler,⁸ of St. Louis, which remained well for seven months and then died from cholangitis; one by Behrend,⁹ of New York, well after one year; and one by Merende,¹⁰ of Paris, well, but time not stated.

(b) Attempts have been made to bridge the gap by means of autogenous grafts, the tissues used being the appendix, pieces of fascia and sections of veins. These attempts, made on animals, have invariably failed, and I can find no case in which they have been used in the human. When veins were used, the lumen remained permeable for variable periods up to three months, but beyond this time stenosis occurred without exception. Shelton Horsley¹⁰ explains this by stating that there seems to be a biologic law of immunity which protects tissues normally in contact with irritating discharges from damage from them; and that other tissues invariably suffer damage when accidentally placed in contact with such discharges.

(c) The biliary fistulous tract has been used. Murphy¹¹ reported a case that functioned for eight months, but which eventually succumbed. All other similar attempts failed.

(d) A loop of jejunum has been used unsuccessfully, failure being due to ascending cholangitis and liver abscesses.

(e) In a few cases the hiatus was at the liver surface, with no duct available for anastomosis. In these an hepatostomy, or hepatoenterostomy, has been done, but with very meagre success.

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TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting held January 3, 1921

The President, DR. G. G. ROSS, in the Chair

INTUSSUSCEPTION

DR. T. TURNER THOMAS presented two infants: the first, a boy, when aged seven months, October 8, 1919, at about 8.30 A.M., was seized with severe pain in the abdomen. Began to vomit soon afterward and continued to do so. No bowel movements after pain began. At 9 P.M. Dr. M. V. Leoff was called and he in turn called in Dr. James H. McKee who diagnosed intussusception and advised immediate operation. This was begun about 2 A.M. at a private hospital, Doctor Leoff assisting. Right rectus incision with its centre about opposite the umbilicus exposed a mass which was found to be an intussusception. There was no evidence of adhesive inflammation, and by gentle traction on the entering portion of the small intestine and pressure on the distal end of the mass the intussusception was slowly reduced and proved to be of the ileocecal variety. The cæcum was considerably thickened and indurated from œdema. The abdominal wound was closed and dressed and supported by adhesive-plaster strips across the abdomen. Recovery was without incident and the patient sent home in a week.

The second, a girl, when four months old, was perfectly well until the evening of October 29, 1919. She suddenly and without any apparent cause began to cry. This continued all night, and the following day Dr. Israel Myers was called. During this day and the next no relief was afforded. Two stools had occurred so that there was not complete intestinal obstruction, and this made the diagnosis more difficult. No abdominal tumor could be felt even by digital examination of the rectum. Doctor Myers called in Dr. James H. McKee on Saturday and intussusception was diagnosed. Operation was begun about 8 P.M. on the same evening at St. Agnes Hospital. A right rectus incision opposite the umbilicus exposed distended small intestine. The large bowel was found above and to the left side of the abdomen and soon seen to be the site of an indurated mass which proved to be an intussusception. The proximal end of it was exposed with considerable difficulty near the midline at the level of the transverse colon. The entering portion of the small intestine (intussusceptum) was held firmly and closely to the posterior abdominal wall and was exposed with much traction on the surrounding viscera. The distal end of the intussusceptum was felt and seen to extend more than

EXCISION OF PORTION OF HUMERAL HEAD

halfway through the sigmoid loop and to move backward and forward within the intussusciens, showing that it was not adherent. After prolonged but gentle traction on the small intestine and pressure from below on the end of the intussusceptum it was gradually and completely reduced.

There were no adhesions and no lymph-masses indicating inflammation. It was observed in this case that as the final steps of the reduction were taking place the ileocecal junction appeared first, then the base of the appendix, followed by the whole appendix, and finally the end of the cæcum successively. This would seem to indicate that the last part to appear was the first to go in in the formation of the intussusception, *i.e.*, that the first part to invaginate was the end of the cæcum and not the ileocecal junction as commonly supposed. Healing was uneventful and the patient was taken home at the end of a week.

EXCISION OF PORTION OF HUMERAL HEAD FOR RECURRENT DISLOCATION OF THE SHOULDER

DR. T. TURNER THOMAS said that he had referred briefly to the case he was now reporting in a communication now awaiting publication and would like here to develop from later occurrences and findings at operation in this case a very definite cause for some failures following the capsule operation. Of forty-eight shoulders on which operation has been done for recurrent dislocation, about twenty were epileptics. There were two distinct failures in the non-epileptic group and three in the epileptic. The particular cause of the failure was not discovered, except possibly in two epileptics in which the convulsions were very violent. The case here reported was shown at the operation to have recurred after each of two capsule operations, because the wearing away of the two bones forming the shoulder-joint where they come into violent contact in each dislocation had gone so far that their ability to retain the normal joint relations had disappeared. In practically every operation performed by the writer he had found the evidence of this wearing effect always in the same parts, *i.e.*, the posterior portion of the cartilage-covered part of the humeral head and the anterior glenoid margin. It has never seemed possible to determine when it has gone too far to permit a cure by the capsule operation. In one case, operated on eleven years ago, the dislocations had been occurring for between twenty-five and thirty years before operation and have never occurred since, although he had as many as one dislocation a day for one week and three in one day, and at operation a considerable defect was found at the usual site on the humerus and some defect of the anterior glenoid margin. The following case proves that the wearing effect can progress so far that a capsule operation will not be sufficient to cure.

Male, forty years old, an epileptic in the insane department of the Philadelphia General Hospital. First capsule operation done June 19,

1919, the second October 11, 1919. About December 1, 1920, he sustained the second dislocation following the second operation. After the first the shoulder had been immobilized about three months in an effort to add to the cicatricial tissue at the site of the original capsule tear and thus prevent further dislocations. A few days after this last dislocation an interne attempted reduction of the dislocation, and although he was confident he accomplished reduction, could not keep the head in the socket. A few days later still the writer had a similar experience. On December 13, 1920, with much difficulty and care the capsule was exposed through a posterior axillary incision. On opening the joint nothing more than the wearing away of the two bones at the usual sites was discovered, but while the humeral head could be placed in the glenoid cavity it could not be kept there because the glenoid would not retain it, but permitted it to slip over the anterior margin into the subcoracoid position. As the capsule operation had been a complete failure he did a partial excision of the humeral head as described and illustrated in the *ANNALS OF SURGERY*, April 2, 1917, p. 493. Both wounds were closed completely except for a small rubber drainage tube opening in the axillary wound. The tube was removed on the following day and the healing was uneventful.

With regard to the underlying pathology of shoulder dislocations, nearly twenty years ago Dr. G. G. Davis began to produce these dislocations on the cadaver, and he produced by hyperabduction apparently exactly the kind of dislocation that one usually gets in life. They could produce as many as they pleased and study them as much as they wanted. One thing he observed early was what Doctor Allis expressed forcibly, that it was difficult to prevent spontaneous reduction. After the head goes out of the socket in hyperabduction and the arm drops to the side there is a great strain on the head in the direction of the socket. But in many instances the anterior glenoid margin by its pressure against the posterior cartilaginous portion of the head offers an insuperable obstruction. In the cadaver dislocation, as Allis pointed out, the head slips over this obstruction easily and probably often does in life. When the locking occurs the pressure is so great that there soon develops a more or less deep groove in the humerus and a flattening of the anterior glenoid margin. In the excision he removed only the part of the head that offered resistance to the anterior glenoid margin and this constituted only a small portion and the only part that projects out of the socket in the dislocation. It is difficult to conceive of a dislocation occurring afterward. It may be possible, but he felt certain that if any part of the head leaves the socket in hyperabduction it can not stay out when the arm comes down to the side. One patient had three capsule operations done on his right shoulder preceding the excision, but all were failures. But there have been no dislocations complained of since the excision in the right shoulder about four years ago, and in the left one and a half years ago.

STRANGULATION OF AN INGUINAL HERNIA

STRANGULATION OF AN INGUINAL HERNIA FOLLOWING A HALSTED OPERATION

DR. T. TURNER THOMAS presented a young man who, soon after rising from bed, on December 11, 1920, and while he was wearing a truss, was seized with severe pain in the region of his left inguinal hernia and throughout his abdomen, such as he had never experienced before. He was admitted to the Northeastern Hospital about 8 A.M. the same day and operated on about 9 A.M. Examination just preceding operation revealed a small, firm tumor at the site of the external inguinal ring about the size of a walnut which the interne had tried to reduce without success. He had no bowel movement for twenty-four hours preceding admission. The hernial tumor was very tender to pressure which caused a nauseating pain in the abdomen. There was marked abdominal rigidity.

About twenty-five years ago he says he was operated on for a left inguinal hernia. March 22, 1919, he was operated on for a double inguinal hernia, but in the following June had a recurrence on the left side and a third operation was done for it on August 6, 1919. When fully etherized for the fourth operation on December 11, 1920, light pressure reduced the hernia fully. Upon exposure by incision the hernial sac was found protruding from the external ring only, and there was no bulging in any other part of the canal. The vas deferens was seen coursing upward and outward lying on the external oblique aponeurosis, and it was traced to the site of the internal ring where the finger could be pushed easily through a considerable opening in the external oblique. There was no protrusion here at the time of the operation, and none was found on examination just preceding operation, but the patient says that the only hernia he knew anything about preceding this acute attack was at the internal ring where he said the pressure of the truss pad was exerted. A few veins were found passing upward with the vas and disappearing through the internal ring.

The external oblique was divided as in a Bassini operation, the hernial sac was opened and the index finger passed through the neck of it into the abdominal cavity. The patient at this time coming partly out of the ether and straining the muscle gripped the finger very tightly, indicating that the strangulation was probably due to this muscle contraction. The internal oblique and transversalis muscles were found separated from the shelving edge of Poupart's ligament and this separation continued for an inch or more to the outer side of the internal ring. The operation was completed as in a Bassini, the remains of the cord being left between the internal oblique below and the external above.

DR. HUBLEY R. OWEN said that they had quite a number of cases of hernia in the Police and Fire Departments. Many of these cases have been operated upon with excellent results. There had not been many recurrences. It was his opinion that of these recurrences the majority are due to lack of after-care of the patient, and not to the technic em-

ployed at the time of the operation. During his own absence, without meaning to say anything derogatory to anyone who may have substituted for him, the number of cases of recurrent hernia increased three times the number they had usually had. When he investigated he found men on active duty in the Police and Fire Departments one month after their discharge from the hospital. The rule had been to order a man on light duty one month after his discharge from the hospital, and no heavy duty for three months after the operation. He believed this to be a very important point. Of two cases of recurrent hernia operated on recently, he found that they had returned to laborious work in less than a month after the primary operation. It is the usual thing in a hospital that after the stitches have been removed the resident discharges the case in about two or three weeks, and no advice is given to the patient, and he returns to laborious work too early.

He had had two unusual cases recently. Both were bilateral inguinal herniæ. They returned to him six weeks after operation and each had a femoral hernia on the side on which he had transplanted the rectus muscle.

SLIDING HERNIA OF THE URETER

DR. GEORGE G. ROSS read a paper with the above title, for which see page 613.

AMNIOTIC HERNIA

DR. E. J. KLOPP reported the case of a female child delivered at full term July 22, 1920, by Dr. George A. Ulrich. It was the mother's first pregnancy. The head and shoulders were born spontaneously, the body stuck and required extraction. The membrane over a large abdominal protrusion was torn, and there was bleeding from the vessels of the cord. A clamp was applied to control the bleeding, the cord was ligated and cut. A large pad of cotton was placed over the abdomen and the child was taken to the Jefferson Maternity Hospital, where it was operated upon fifty minutes after birth.

Occupying the greater part of the abdominal wall was a hernial protrusion, the covering was almost transparent and composed of amnion and peritoneum. A considerable portion of the small and large intestines had escaped through a two and one-half inch opening in the sac which occurred during birth. The liver was rotated, adherent and part of it contained in the protrusion.

The intestines were returned to the abdominal cavity, which was poorly developed. No attempt was made to free the liver. After ligation of the vessels the excess amnion was excised and the opening closed by mattress sutures of catgut, making considerable pressure on the abdominal contents. No attempt was made to bring the muscles together. The skin was incised around the margin of the hernia and extensively undermined in all directions, then sutured vertically over the amnion.



Fig. 1.—Amniotic hernia.



PATENT URACHUS WITH SARCOMA DEVELOPING IN THE WALL

Seven days later some of the skin sutures pulled out, there was a little infection and finally retraction of part of the skin. The inner layer remained intact.

At first the child was fed modified milk with a dropper, later it took the bottle. Weight at birth, four pounds twelve ounces; weight September 6, 1920, five pounds three ounces; weight December 1, 1920, eight pounds three ounces. Accurate measurements of the hernia were not obtained before the operation. The child digested well, it cried as healthy children cry and was otherwise normal. The condition five weeks after birth is shown in the photograph (Fig. 1).

About December 1, 1920, it contracted pneumonia, and apparently recovered. Several days later there were symptoms of otitis media. The pediatricist in attendance incised both tympanic membranes. There was a copious discharge of pus from both ears. Notwithstanding free drainage, the temperature continued to rise and death occurred December 17, 1920.

The reporter's opinion was that the opportune time to operate upon cases of amniotic hernia is within a few hours after birth, before the stomach and intestines become somewhat distended with fluid, making closure more difficult, and before the amnion has begun to dry. It is questionable whether one should attempt, at this time, to bring the muscles together when there is a large defect in the abdominal wall.

PATENT URACHUS WITH SARCOMA DEVELOPING IN THE WALL

DOCTOR KLOPP reported the history of a man, aged fifty years, who was admitted to Doctor Stewart's service, Jefferson Hospital, January 26, 1920, whose general health was good until two weeks ago, when he complained of abdominal pain, particularly about the umbilical region. When he applied at the dispensary for treatment, a small amount of thin, yellowish fluid was discharging from the umbilical region. The umbilicus and skin near by were inflamed. There were no urinary symptoms. Physical conditions otherwise were normal.

January 28, 1920, under general anaesthesia, at the suggestion of Doctor Stewart, a curved incision was made above the umbilicus. A small cavity was entered beneath the skin which contained but a few drops of yellowish fluid. A gauze drain was inserted. He was discharged from the hospital February 2, 1920. On March 2, 1920, he was readmitted to the hospital, in the service of Doctor Gibbon, to whom I am indebted for the privilege of operating upon and reporting the case. There was an intermittent sero-purulent discharge from the umbilicus.

Operation (March 3, 1920).—Under general anaesthesia. A ureteral catheter was inserted for five inches. An elliptical incision was made around the umbilicus and then continued down toward the pubes. The umbilicus and tissue surrounding the catheter were excised. The catheter extended to within two inches of the bladder, from there on a cord-like

mass connected with the bladder. The omentum was adherent to the tract about an inch below the umbilicus. The abdomen was closed without drainage. The specimen was incised to demonstrate to students and a small section became detached and probably did not accompany the larger part to the laboratory.

Pathological Report by Dr. W. M. L. Coplin, March 10, 1920.

"Specimen consists of an irregular mass weighing 19 grams. One surface is covered by skin measuring 5 centimetres by 1.3 centimetres. Near the centre of the skin is the umbilicus, which is funnel-shaped and very deep, admitting the little finger to the first joint. As far as one can see, the funnel is lined by skin. A probe 2 millimetres in diameter inserted into this depression enters a canal which terminates 9 centimetres from the skin surface. At one area 4.5 centimetres from the skin, the canal has been opened, disclosing a rich red lining membrane. Fixation in 10 per cent. formalin; usual laboratory stains.

Histology.—The centre of the section is occupied by a canal 0.3 centimetre in diameter, small arc of which is lined by squamous epithelium, and probably represents the original tract. The remainder of the wall of the sinus is inflammatory tissue. Outside of this is considerable loose areolar tissue and some more compact and fibrous structure. Near one margin and extending into the tissue is a mass of mononuclear cells also containing a few giant-cells; it is believed that this area is sarcomatous. The structure believed to be new growth extends close, if not actually, to the periphery of the specimen, and it seems unlikely that all the diseased tissue has been removed.

This description is based on a transverse section of the specimen about one centimetre internal to the external opening.

Diagnosis.—Umbilical fistula, obviously the remains of a fetal structure, possibly urachus or omphalomesenteric canal. In the thickened inflamed wall sarcoma is believed to be developing."

He received four X-ray treatments at three week intervals after the operation.

The Wassermann was plus 2 prior to the operation and plus 1 December 31, 1920. There has been no history of lues nor has he ever had treatment for it. The wound is healed and symptomatically he is well.

ACUTE INFLAMMATION OF MECKEL'S DIVERTICULUM

DOCTOR KLOPP presented a man, aged forty-seven years, who was referred by Dr. C. D. Smith to the Jefferson Hospital, November 19, 1920. He had complained of indigestion and gaseous eructations for many years. Frequently he was compelled to fast for several days. There often was nausea but he seldom vomited. Two years ago he was supposed to have had an attack of appendicitis. He was confined to bed for three days at that time.

On November 17, 1920, he had nausea and vomiting which was followed by generalized abdominal pain. He took cathartics, but his bowels did not move. The pain became more intense, and two days after the onset he called Doctor Smith.

On admission his temperature was 100.6°; pulse, 100; respiration 20. His facial expression indicated pain. The abdomen was distended, there was tenderness throughout, most marked, however, over the right lower

PYONEPHROSIS WITH LATE SECONDARY HEMORRHAGE

quadrant where a mass could be detected. On November 19, 1920, under general anæsthesia the abdomen was opened over McBurney's point. Several ounces of turbid fluid were wiped away. The mass was walled off by a gauze pack. A structure two inches long and three-fourths inch in diameter, having a mesentery and springing from the ileum approximately eighteen inches from the cæcum, dark red in color and in several places gangrenous, was removed by the technic one removes the appendix; in fact, this structure resembled an appendix very closely. From its location and appearance we called it an acutely inflamed Meckel's diverticulum. To the right of a hard, omental mass, and attached to it, was the appendix. It also showed evidence of inflammation and therefore was removed. Two gauze drains were inserted with the usual closure in such cases. The man made an uninterrupted recovery.

Cases of inflammation of Meckel's diverticulum are not common. It is said that there may be recurrent attacks, or that there may be perforation and peritonitis. One could not say whether the attack of so-called appendicitis two years ago actually was appendicitis. If the appendix had been encountered first in this operation the diverticulum might have been overlooked.

PYONEPHROSIS WITH LATE SECONDARY HEMORRHAGE

DR. ARTHUR E. BILLINGS reported the history of a colored man, aged twenty-five years, who was admitted to the Bryn Mawr Hospital October 20, 1920, complaining of pain and tenderness in the region of the left kidney, with fever and sweats. He said he had had bladder trouble since early childhood. In 1918 he had a large stone removed from his bladder at Camp Sherman, Ohio. Later in 1918 he had a fourth attack of pneumonia in Camp Humphreys. He stated that all of the pneumonic attacks had been on his left side. Had not had any other serious illness and denied all venereal infection.

About August 1, 1920, while chauffeuring in France, he began to have pains in region of left kidney, with increased frequency of urination, but at this time was not disturbed at night by either pain or frequency. He was given some medicine by a French physician which gave him much relief. Several weeks later his symptoms became aggravated and he observed "blood, pus and gravel" in his urine. This, he said, increased until his urine was about half sediment. About this time he returned home and consulted Doctor Ferries, who referred him to Doctor Pancoast for X-ray; the skiagraph showing a rather long, conical stone in the left renal pelvis, apparently engaged in the ureter. He was then referred to me by Doctor Ferries on October 20, 1920, with a temperature ranging from 100° to 103°; pulse, 90 to 100, with sweats and a large, palpable, tender mass in left kidney region. Leucocyte count was 19,200, and his urine was loaded with pus, but was negative otherwise, except for a heavy trace of albumin. Kidney function (indigo carmine) showed a total

elimination of about 45 per cent. in two hours, all of which was from the right kidney. Physical examination, aside from that already noted, was negative. Blood, Wassermann was negative.

On October 22, 1920, under N_2O and O-ether anaesthesia the left kidney was exposed through the usual curved incision in the back. A nephrectomy was done with some difficulty, as the kidney was very adherent, particularly to the descending colon. The kidney was very much enlarged and was merely a shell with a large abscess cavity within, as the renal tissue seemed to have been almost entirely destroyed. Urine output for first twenty-four hours after operation was 875 c.c., and by the fifth day it had increased to 1975 c.c. His convalescence in the hospital was satisfactory and his wound cleaned up rapidly under the influence of Dakin's solution. Culture from pus showed bacillus coli communis and pathological diagnosis was tuberculosis of kidney with pyonephrosis. He left the hospital (November 18, 1920) twenty-six days after operation, with a small sinus from which there was a very slight sero-purulent discharge. Cicatrization seemed to have been satisfactory, and he gained about twelve pounds in the following two weeks. On the 4th of December he had pain in region of wound and back, with bloody discharge from sinus. On December 6th he had a great deal of pain in back and left upper abdomen, with increased bloody drainage from sinus. (Admitted to Pennsylvania Hospital.) Temperature, 101° ; pulse, 120. Tenderness in left upper abdomen with indefinite mass formation. Wound opened; considerable blood-clot evacuated. No active bleeding point found, except from excessive granulation which gauze packing controlled. Temperature ranged from 101° to 103° . Leucocyte count, 27,200. Blood culture, negative. Blood, Wassermann weakly positive. On December 16th had rather profuse hemorrhage, at least twenty-five ounces. Wound tightly packed with gauze. Patient profoundly septic. A donor was obtained for transfusion, but their bloods were incompatible, and another was not secured. An intravenous infusion of salt solution caused temporary improvement, but patient died on December 17, 1920. Permission for autopsy was not granted, but exploration through wound revealed that hemorrhage had probably occurred from ulceration and sloughing of the ligated renal vessels, as they were necrotic with a large quantity of recent blood-clot about them.

Attention is called to this case because of the elapse of fifty-five days between operation and occurrence of secondary hemorrhage, and the fact that he was looked upon as a certain operative recovery when discharged from Bryn Mawr Hospital.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting held January 12, 1921

The President, DR. WILLIAM A. DOWNES, in the Chair

MARGINAL ULCER OF THE JEJUNUM FOLLOWING GASTRO- ENTEROSTOMY

DR. EUGENE H. POOL presented a man who had been operated upon elsewhere in May, 1919, for duodenal ulcer, a posterior gastroenterostomy having been performed, with exclusion of the pylorus. The patient returned six months later with gastric hemorrhages, and received medical treatment. He came to the New York Hospital in December, 1920, suffering from symptoms of gastric ulcer. The X-ray plates (Fig. 1) showed a large ulcer in the region of the gastroenterostomy and no bismuth passing through the pylorus.

Operation was performed five weeks ago. Many adhesions were found around the pylorus and it was impossible to ascertain how it had been occluded. There was a short loop posterior gastroenterostomy. The tissues around it were markedly indurated and infiltrated. The stomach was opened through its anterior wall and the stoma and ulcer inspected and palpated. There was a penetrating ulcer about 2 cm. in diameter in the posterior wall of the jejunum close to the stoma. It had an elevated, hard border. The stomach and jejunum were separated and the indurated tissue was excised from around the orifice; in each organ the opening in the posterior wall was then closed by sutures from within the stomach (trans-gastric), reinforced by an outer layer from below. The jejunum could not be closed transversely on account of the extensive adhesions and a longitudinal suture had to be made, but it was found that this diminished the lumen to a dangerous degree and left an insecure closure, so the jejunum was doubled on itself at the middle of the line of suture (like a V), bringing the two halves of the line of suture into contact and placing Lembert sutures between the adjacent segments anteriorly and posteriorly. Above this approximation, to reestablish the patency of the jejunum, a suture anastomosis was made. A posterior gastroenterostomy did not seem appropriate nor feasible and the opening in the anterior wall of the stomach was used for an anterior gastrojejunostomy about fourteen inches down from jejunum. An eight-ounce bismuth meal observed at intervals by fluoroscopy now passes quite slowly, taking about four hours; the patient complains of no discomfort.

EXOSTOSIS OF SCAPULA

DR. SETH M. MILLIKEN presented a case of exostosis of posterior border ventral surface of the scapula, projecting against a rib. He stated that the patient, a girl aged twenty years, had for the last six months noticed "a scraping in her right shoulder," which was not painful but made so much noise that it disturbed her.

Examination showed a well-nourished young woman. Any motion of her right shoulder caused a knocking noise audible across the room. The right shoulder was held slightly lower than the left. Careful general examination showed no abnormality except in the right scapula, as follows:

The posterior border of the right scapula was slightly winged out. Pressure caused less yielding than on other side. Movements of the scapula were accompanied by a knocking sound and a palpable bumping. This bumping should be pathognomonic, as it was due to the exostosis jumping over the ribs in movements of the scapula. Very clear X-rays made by Dr. L. G. Cole proved the diagnosis. Doctor Cole reported as follows: "Plates taken in two planes show definite evidence of a rather large exostosis on the ventral surface of the scapula close to its posterior border, about the junction of lower and middle thirds. This projects anteriorly and when the arm is moved it slips over the ribs, giving the characteristic sounds and vibration, which is so distinctly felt."

CHRONIC EMPYEMA

DR. WILLY MEYER presented a girl in the later twenties, whom he had presented before this society two years ago when her wound was in the course of healing. She had had an empyema when four years of age when she had a rib resected; the empyema cavity had never healed. Doctor Meyer said she came under the care of a number of surgeons later on, and one could see the results of their work by the number of scars surrounding the scapula. Due to their work the greater portion of the empyema cavity was closed, but a large cavity persisted which, when she came under his care in 1915 with a fistula, was shown by bismuth injection and radiography to extend parallel with the spine from the shoulder to the lower border of the ribs posteriorly. It was 1½ inches wide. According to two similar cases which he had had before, it had been his experience that the only way to attack this type of empyema was to remove the entire roof that covered the cavity. Making an incision down through the ribs and trying to free the lung by Delorme's decortication was not feasible. He planned to do the work in stages and under regional with local anæsthesia. When the cavity was exposed he was amazed to see how far it extended downward; it looked as though it reached into the small pelvis. Before he had completed the operation the patient went into shock. The large wound was tamponed and the



FIG. 1.—Marginal ulcer of the jejunum following gastroenterostomy.



THE MURPHY BUTTON IN INTESTINAL WORK

skin flaps turned in. There remained two sinuses, one running up and one running down, each into the respective angle of the original cavity. He first attacked the lower one and in a third sitting the upper one. There were a number of bronchial fistulæ which persisted, but at last closed after repeated cauterization. To-day, after almost five years of continuous treatment, he could show the patient completely cured. The healing wound resembled a posterior mediastinotomy; the heart could be seen pulsating. There was full function of the arm.

Doctor Meyer stated that three cases of this type of chronic suppuration had taught him the necessity of going ahead cautiously. These patients frequently went into shock, even when every precaution had been taken. He believed that where possible local anæsthesia should be used.

THE MURPHY BUTTON IN INTESTINAL WORK

DR. WILLY MEYER presented a woman who was operated on by him in 1917 for a strangulated gangrenous umbilical hernia, with resection of the gut and an end-to-end anastomosis. She was at that time fifty-three years of age and had had the umbilical hernia for eighteen years. She was brought to the hospital and operated upon at midnight. The necrosis had spread to either side of the incarcerated sector; it was necessary to resect 55 inches of the ileum. The walls of the afferent part of the intestine were quite distended and œdematous, those of the efferent part contracted and anæmic. Under these conditions Murphy's button seemed to offer the best means of bringing the cut ends of the intestine together quickly. Doctor Meyer emphasized his belief that under these conditions the Murphy button had its clear indication. The radical operation for umbilical hernia was added. The patient left the hospital cured.

In March, 1920, Doctor Meyer was again called to see this patient, and found her with all the signs of a constriction of the pylorus which had developed rather quickly. A tumor could be palpated. Again a transverse incision was made nearer the lower border of the ribs, but the stomach could not be conveniently exposed. He then added a median incision up to the xiphoid process, but not dividing the peritoneum. Now it was feasible to reach the lesser curvature and the strictured pylorus. Metastatic carcinomatous nodules covered the entire stomach anteriorly as well as posteriorly, also the transverse mesocolon. It did not look as though operation would avail anything, but a posterior gastroenterostomy with the button could still be done. This brought out the second point he wished to make, that when one saw these patients whose condition seemed totally hopeless, one should nevertheless endeavor to help them by making an anastomosis. The Murphy button offered the only means of doing this. In this case he found a small area in the posterior wall where he could implant the button. The patient certainly was in a very poor condition on March 20, 1920, the day he operated. She now weighed fifteen pounds more than at that time. The case showed what

could still be done with the help of the Murphy button in these otherwise totally intractable cases.

DR. FREDERICK T. VAN BEUREN, JR., quoted from the records at the Roosevelt Hospital, stating that in the last ten years there were twenty-three cases of resection of the ileum. Of those cases fifteen had died and eight recovered; that was a mortality of 66 per cent., which was pretty high. It was no higher, however, than the statistics of the Massachusetts General Hospital in similar cases. He found four cases among the twenty-three in which the Murphy button had been used. Of these two died and two recovered, a mortality of 50 per cent. Doctor Van Beuren said that he personally had done only five such operations with the Murphy button. Of these three recovered and two died, a mortality of 40 per cent. So he still thought with Doctor Meyer that, though many other men had discontinued its use, the Murphy button still had a useful place in certain selected cases.

DR. CHARLES N. DOWD said that he had not used the Murphy button for several years excepting in one locality. That locality was the hepatic flexure of the colon, in making a side-to-end anastomosis with the terminal ileum after resection of the ascending colon. It here had the advantage of rapidity, simplicity and cleanliness, and the disadvantages of the button were reduced to the minimum since it lay in the large intestine after its separation and easily passed to the anus. It was a valuable resource in debilitated patients. One part of the button was fastened into the end of the ileum with a purse-string and the other was dropped into the open end of the colon and pushed through a small cut in its side. The button was then locked. The end of the hepatic flexure was closed, and the suture was so secured in the abdominal wound that access to the suture line could be obtained if desirable. Charles H. Mayo had described the procedure at the meeting of the A. M. A. in 1916.

DR. HOWARD LILIENTHAL said there was one time when the Murphy button was extremely useful, and that was when one wished to operate quickly, as when a patient had gangrene of the gut and was in desperate straits. He incised the gut through the gangrenous portion, slipped the two halves of the button into the two legs of the involved loop far into the healthy portion, and, after nicking the intestinal wall so the cylinders of the button could be pushed through, he clamped the button home without sutures. He then ligated both legs of the gut with a single stout crushing ligature and cut away the part bearing the gangrene. The two stumps were carbolized and did not need to be inverted. The ends of the knot could be left long, protruding from the external wound, so that when the stumps were loose the slough could be drawn out of the wound.

DOCTOR MEYER believed that if surgeons followed the technic in the use of the Murphy button as Doctor Murphy himself described it, there would be fewer deaths from accidents following its use. One of the reasons for his having brought the patients here to-night was to show that the

SADDLE-BACK ULCER OF STOMACH

Murphy button had its indication. In patients with shock after strangulated hernia it certainly did save time. In one very weak patient with cancer of the stomach whom he had once shown here he had used two Murphy buttons. In this patient he found the posterior wall of the stomach completely adherent to the transverse mesocolon. Resection of the stomach and also of the transverse colon became imperative. End-to-end union of both organs was done with the button and the patient made a good recovery.

SADDLE-BACK ULCER OF CENTRAL THIRD OF STOMACH

DR. ALLEN O. WHIPPLE presented a woman, aged twenty-six years, who three weeks before admission was seized with sudden, severe pain referred to left lower quadrant of her abdomen. This persisted, growing worse for three days before admission. During the three weeks she had had persistent nausea and had vomited after each meal. No pain in the epigastrium after meals, no tenderness, no blood in the vomitus, no tarry stools, bowels regular, no hæmaturia, no history of digestive disturbance prior to this outbreak since removal of appendix ten years before. There were tenderness and increased resistance in the left lower quadrant. Three days later an examination of the vomitus and stool gave a positive guaiac test. She vomited 600 c.c. of coffee-ground material. Attempts to use fluoroscope and röntgenograms were useless, owing to her inability to retain bismuth. The coffee-ground material was the only evidence made out of a gastric lesion. An exploratory section was made because of her severe pain and dehydration before operation. She was given a hypodermoclysis.

Operation (August 23, 1919).—Through a suprapubic incision nothing was found to explain her left lower quadrant symptoms. Uterus and adnexa were not inflamed; sigmoid was normal.

Situated in the lesser curvature of the stomach was an indurated mass lying saddle-like over the lesser curvature. No enlarged, hard nodes were felt in the gastrohepatic omentum, or near the cardiac. There were no adhesions binding the stomach to liver or pancreas. A sleeve resection was decided upon inasmuch as the pylorus was not involved and the saddle ulcer could be removed with the central third of the stomach. Payr clamps were used, central third excised, cut ends cauterized, posterior serosal sutures of No. 0 chromic applied and Payr clamps removed. The crushed ribbons were trimmed and the through-and-through continuous sutures of No. 0 chromic were placed, using a lock stitch for the posterior line and inverting Connell suture for the anterior line. Serosal suture was then continued to point of beginning.

Post-operative Course.—She complained of nausea at intervals but had no vomiting at any time. She left the hospital on the seventeenth day, in very fair condition, on a selected post-operative gastro-

enterostomy diet and was given detailed advice as to her diet and bowel regime. Wound healed by primary union.

Follow-up.—She has been seen five times. For seven months she continued to have morning nausea and regularly vomited her morning meal, but not other meals. Menses regular, no evidence of pregnancy. Nausea was somewhat relieved by cerium oxalate. Seven months after operation röntgenograms showed no retention. Stomach emptied rapidly and was entirely empty in six hours.

On her fifth visit, thirteen months after operation, she was symptom free. Nausea had entirely disappeared. No tenderness or mass was made out. Anatomic, symptomatic and economic result for thirteen-month interval was optimum or 444.

LATE RESULT AFTER RESECTION OF THE STOMACH FOR CARCINOMA

DR. WILLY MEYER presented two patients who had been operated upon for gastric carcinoma to demonstrate the possibilities of surgery in such cases. Unless a fair number of permanent cures were reported showing the final results, the medical men would not be so ready to turn over these cases for operation at the earliest possible moment. From the Mayo Clinic and from many clinics abroad a series of cases of carcinoma of the stomach had been reported which showed good late results.

A former patient came to his office last fall; he did not recognize her at first, but soon remembered having done a resection for carcinoma five years ago. He then thought he would like to follow up other cases similarly operated upon. In this way he succeeded in quickly tracing five such patients. The first patient he now presented was a man who came under his care in March, 1916, when fifty-six years of age. At that time he had a big palpable tumor of the stomach with all the signs of beginning pyloric carcinoma. With the transverse incision the tumor was exposed. It was impossible to do a posterior gastroenterostomy, so an anterior gastroenterostomy was done and the patient did well and made a good recovery. He had gained 18 or 20 pounds, was now sixty years of age, and was in perfect condition.

Speaking of the transverse incision, Doctor Meyer stated that he found that with this incision the layers of the abdominal wall did not come into as firm an apposition as they should and he was not using it as much as he did some years ago. From under the muscles one sometimes had secretion for some time; but the wound would never separate.

The second patient presented was forty-one years of age in 1815 when operated upon at the Post-Graduate Hospital, also through the transverse incision. A resection of the stomach was done for a tumor on the major curvature and a constricted pylorus. He did a posterior gastroenterostomy with the help of a Murphy button.

In looking up his patients he had found three men who had lived quite a number of years after operations for carcinoma of the stomach. One,

LATE RESULTS AFTER RESECTION FOR CARCINOMA

operated upon when sixty-one years of age, lived ten years, and then died of arteriosclerosis. There were two more cases of gastric carcinoma still alive in the city, one after a resection according to Billroth No. 2, and one after a Reichel-Polya-Balfour operation. Doctor Meyer said he felt absolutely sure that if other surgeons would follow up their patients they would find quite a number that were thought to be incurable alive and well after a number of years. After all it was probably a question of the virulency of the cancer, whatever it might be, which determined the patient's fate.

DR. JOHN F. ERDMANN presented three patients. The first was a man, aged forty-nine years, operated on in December, 1910. He had a large tumor and quite a collection of enlarged glands. His physician said he entertained very little hope of his recovery. At operation four-fifths of the stomach was resected for adenocarcinoma.

The second patient, a woman aged seventy years, was an emergency case. A diagnosis was made of probable ulcer of the lesser curvature. The X-ray plate showed a condition like carcinoma. The patient was operated upon in November, 1920. A sleeve resection was done of the middle third for a large ulcerating mass adherent to the pancreas. There was said by the pathologist to be no malignancy, but only an ulcer.

The third patient, Doctor Erdmann said, had a bearing on the subject of the evening. This man, aged twenty-six years, came under his care in January, 1920, with clinical symptoms of duodenal ulcer for which he was operated upon on February 10, 1920. It was found in resecting the ulcer from the anterior superior portion of the duodenum that there was a second ulcer on the posterior surface just opposite the first, a so-called kissing ulcer. This was also resected and, fearing a stenosis, a gastroenterostomy was performed. In May the man returned, complaining of the same symptoms that he formerly had. He was treated with alkalies and dietetic measures. On November 18, 1920, he returned with all symptoms marked, and pain deflected to the left lower quadrant. Thinking the man had a recurring or marginal ulcer he was operated upon on December 17th. At operation examination of the former resection showed no original disease. The duodenum just outside the pyloric sphincter was found distended. The duodenum was fully normal in size, possibly a little larger. In the absence of any other pathological condition, he felt that there was probably a marginal ulcer and further search revealed a perforated ulcer the size of a twenty-five-cent piece at the mesenteric margin of the jejunum. The ulcer was excised. Normalcy of the gastrointestinal tract was established by closing the opening in the stomach and also that of the jejunum.

DR. JOHN DOUGLAS said he would like to place his cases of malignant disease of the stomach on record. He had done twenty-two resections, nineteen for carcinoma and three for sarcoma. One case of sarcoma was shown before the society one year ago. That patient still is well two

years after operation. One of the carcinoma patients was operated upon in March, 1912, and another in November, 1912, eight and nine years ago, and both were without signs of recurrence. Two other cases were operated upon a little over two years ago and were perfectly well. Two cases operated upon during the last seven or eight months were still well. A total of six cases of carcinoma and one of sarcoma, operated upon from five months to nine years ago, were still alive and well.

SLEEVE RESECTION OF MID-GASTRIC ULCER

DR. WILLIAM A. DOWNES showed a slide and a picture of a patient upon whom he did a sleeve resection for a mid-gastric ulcer in November, 1914. The slide showed the stomach before operation with retention, and a second slide showed the stomach after operation when it emptied in four hours. The woman came in a few days ago and he had had the picture taken to check up. It showed that the stomach was functioning perfectly. The patient suffered no discomfort of any sort. She had gained in weight, married, and did not know that she had ever had an operation. The sleeve operation showed remarkably good results. Sir Berkeley Moynihan, in a recent talk, apparently advised the removal of the pyloric portion of the stomach in these cases and suturing the jejunum to the open end. He made no mention of this operation at all. Doctor Downes stated that he had had six out of seven patients operated upon by this method living, one for more than seven years, and the results in all had been very satisfactory. He thought this operation had a very definite field for a selected type of cases.

DR. GEORGE WOOLSEY said that one reason the results were not as good as they otherwise would be was that this operation was often done for ulcers of a severe type, such as large, deep ulcers on the posterior wall adherent to the pancreas or ulcers with marked hour-glass contraction. The immediate results of sleeve resection were usually very good. Doctor Woolsey stated that he had had nine cases of sleeve resection and one had had to be reoperated upon on account of adhesions and constriction of the pyloric segment. So far as the follow-up results went, they had not been as satisfactory as those of some other operations, but that was to be expected because of the type of cases operated upon by this method.

MARGINAL, GASTROJEJUNAL OR PEPTIC ULCER SUBSEQUENT TO GASTROENTEROSTOMY

DR. JOHN F. ERDMANN read a paper with the above title, for which see page 434, ANNALS OF SURGERY, April, 1921.

DR. EUGENE POOL stated that he had operated upon three cases of marginal ulcer, the one he had first shown and two others. In addition, an unusual case of similar type, namely, an ulcer following a Finney pyloroplasty for duodenal ulcer of the anterior surface. At operation on the last case dense adhesions about the pylorus and duodenum made it

PEPTIC ULCER SUBSEQUENT TO GASTROENTEROSTOMY

necessary to open the duodenum for exploration. He found an ulcer 1.5 cm. in length, not at the site of the original ulcer, but at the site of the upper end of the posterior suture line. The ulcer was markedly indurated. The original operator stated that non-absorbable suture had been used. Doctor Pool said that he wished to emphasize the following important point: On account of the possible disadvantages and even dangers which may result from a gastroenterostomy, it is always important to demonstrate that the procedure is positively indicated before such an anastomosis is made. If on inspection and palpation there is any uncertainty of the presence of an ulcer, the viscus should be opened to obtain positive information. In several cases in recent years he had avoided an unnecessary gastroenterostomy by this practice.

In another case the marginal ulcer was not only dependent upon non-absorbable suture, but the case showed an apparent individual predisposition to recurrence of marginal ulcer. In this case a posterior gastroenterostomy was made for ulcer of duodenum. Six months later the patient presented himself again with symptoms of ulcer. Doctor Pool operated again and found an ulcer, 1 cm. in diameter, close to the left extremity of the gastroenterostomy opening. On the floor of the ulcer was found the knot of the linen thread. He cut the thread and drew out the entire linen suture. This was five years ago, and since this experience he has never used non-absorbable sutures in a gastroenterostomy. There was no evidence of carcinoma. The ulcer was excised and a revision of the gastroenterostomy made. Six months later the patient again had symptoms of gastric ulcer. Again he was operated upon; this time elsewhere, and a marginal ulcer was again found. The surgeon made a resection of the jejunum and excised the ulcer. He did a new anastomosis with a Roux implantation of the jejunum. Some months later the patient returned to Doctor Pool, who found an extensive carcinoma at the site of the last gastroenterostomy. The patient died about four months later. In this patient there was a sequence of two marginal ulcers and a carcinoma.

DR. GEORGE WOOLSEY said that he had not had many jejunal ulcers in the past five years, during which he had not used non-absorbable suture material. During that time he knew of only one of his ninety-odd cases of gastroenterostomy reoperated for a marginal ulcer, and this was done by another surgeon. During that time he had only operated upon one patient for a marginal ulcer and the gastroenterostomy had been done at another hospital about two years previously. The symptoms had recurred about seven weeks before operation. In that case there was no visible thread, but there were clusters of foreign-body giant-cells, indicating the probability of such a suture, according to the pathologist. Doctor Woolsey said he believed non-absorbable sutures were the commonest single cause of marginal ulcer. In a paper by Doctor Eustermann, of the Mayo Clinic, the statement was made that a non-absorbable

suture was the cause of one-third of all marginal ulcers. But it was not the only cause. Doctor Coffee, of Portland, Ore., recently read a paper at Newark and showed some interesting pictures of three cases of jejunal ulcer in which the clamps were thought to be the cause of the ulcer. The ulcer was in a part of the jejunum where the clamp might have done the injury, not close to the anastomosis, but some distance from it. Doctor Woolsey had not seen this occur after the use of clamps. The use of many forceps, as suggested by Doctor Erdmann, might also subject the tissues to trauma and favor the formation of ulcer. If one used the Roosevelt clamps, however, and did not require many, if any, forceps on the edge of the incision, Doctor Woolsey stated that he had had no reason for abandoning the use of clamps in doing gastroenterostomy. Hematoma might be a cause of marginal ulcer or some other slip in the technic of the operation. The X-ray of the patient upon whom he had operated for marginal ulcer showed the ulcer, not so prettily as in Doctor Pool's case, but it made a very definite and positive diagnosis. Doctor Eustermann said that in 65 per cent. of the cases he reported the X-ray confirmed the diagnosis.

Doctor Woolsey asked Doctor Erdmann to explain more fully about the suture he proposed. Was it an exact suture of the mucosa, leaving out the through-and-through suture? Personally, he thought the ordinary method of suturing brought the mucosa perfectly well together. He had had occasion to open the stomach on account of hemorrhage in one instance, nine days after operation, and he found the edges as perfectly apposed as one could possibly make them by any method of exact suture. The hemorrhage was due to the ulcer. In another case upon which he had operated over seven years ago, using non-absorbable suture, and which he had reported previously, the symptoms recurred after twenty-one months. At operation no ulcer was found, but three inches of the non-absorbable suture was found hanging from the stoma. The removal of the suture cured the symptoms, which had resisted all forms of medical treatment.

DR. J. P. HOGUET recited the history of a patient operated upon by him in 1916 whom he showed a few months ago. At that time the patient had had two recurrences of marginal ulcer, one following a modified Polya operation and one after an ordinary excision. After the attack in 1916 an X-ray was taken which confirmed the diagnosis. Another attack occurred in 1917 in which no X-ray was taken but the symptoms were perfectly characteristic. The ulcer resolved under dietetic treatment. A month ago the patient returned with the third attack and a marginal ulcer was shown by the X-ray. This attack subsided after two or three weeks of alkaline and dietetic treatment. It was demonstrated after the attack that there was a chronic stasis at the splenic flexure of something like seventy-two hours. At the present time, Doctor Hoguet said he was tempted to do an exploratory operation to find the cause of the stasis.

He thought this case opened up a train of thought as to whether chronic stasis was not an etiological element in marginal ulcer.

DR. HOWARD LILIENTHAL stated that he had given up the use of non-absorbable suture material after he had had a case like Doctor Woolsey's in which the suture caused the symptoms of ulcer and after removal of the suture the patient got well. Since that time he had not used non-absorbable suture. What had been said about the clamps was especially interesting to him. He had never used clamps in any gastroenterostomy work. The clamp was not justifiable unless used as a crushing machine previous to excision. Where one wanted to retain the parts they should be handled as gently as possible. If a clamp were used it must be with great skill. One must judge of the strength of the clamp and also of the resistance of the individual patient's tissues. Doctor Lilienthal had used various methods, among them the coffee "holding suture." For seven or eight years he had used the rubber-dam method. In applying this method he took a large piece of rubber dam and made a punch hole in it about large enough for a lead pencil. He then placed marking sutures at each end of the proposed stoma. The assistant then pushed the marking sutures through the hole in the rubber dam, which was stretched to a suitable size by the operator, and when the viscera had been drawn through the rubber was permitted to contract so that the operative field was absolutely isolated, and by a material that would do no harm to the area to be operated upon. One could then proceed to make the stoma. The rubber dam did not cause complete hæmostasis, so that one could see just where each suture should go, and when the rubber dam was removed one would have the parts in relation just as they were going to remain. If one used a clamp, after the removal of the clamp the relation of the parts was changed completely.

Doctor Lilienthal said that while he had not had a large number of gastric and duodenal ulcers, he had had a considerable number and he had not had a recurrent ulcer that he knew of with the use of this method and absorbable sutures; and usually when his patients had any fault to find they came back. He had had a patient with a peptic ulcer operated upon sixteen years ago who came back after sixteen years without symptoms. The X-ray did not always show a penetrating ulcer; in order that such an ulcer could be shown by the X-ray it must be on the "sky line," so to speak.

DR. WILLY MEYER said the reason one did not see marginal ulcers oftener was evidently due to the presence of bile running through the anastomosis from the duodenum into the stomach. Ulcers were not found below the point where the bile entered the duodenum. When the acid gastric secretion ran through the pylorus and sufficient bile was not present to neutralize it, the gastric juices produced a deleterious effect. This certainly often was the cause of a duodenal ulcer.

Doctor Meyer always made use of the Roosevelt clamp, but he never

did press hard, just enough to hold the two portions in the proper apposition. Inasmuch as the anastomosis was inside of the place at which the clamps were applied, he did not see why they should be responsible for the formation of a marginal ulcer. He further thought the inner suture should always invert the tissues. He used but two rows of continuous layer suture.

Amongst the many cases of gastroenterostomy which he had had there was but one case of marginal ulcer. In this instance the X-ray specialist suggested the diagnosis of carcinoma at the anastomosis. But it did not appear to be cancer so far as the patient's general condition was concerned. The Einhorn duodenal tube for feeding was used and the patient improved very much. She had been operated upon at the Post-Graduate Hospital one and one-half years before and then came back with the symptoms of marginal ulcer. By means of the tube the parts were placed at perfect rest. The patient recovered without further operation. In cases in which it was difficult to get the consent to additional surgery, or the patient seemed to be a great risk, it was advisable to try intestinal feeding with the duodenal tube passing through the gastrojejunal anastomosis.

DR. JOHN DOUGLAS recalled that he had presented a case of jejunal ulcer before the society about a year ago, and while the subjective symptoms were somewhat similar to those mentioned by Doctor Erdmann, it differed from Doctor Erdmann's cases in the location of the ulcer not being in the stomach or on the margin of the jejunostomy and the fact that no stippling was evident. In the case referred to, the jejunal ulcer developed about a year after the gastroenterostomy. The patient had two hemorrhages after the gastroenterostomy and this, with severe pain and a negative X-ray finding, had aided in making the diagnosis. At the time of the operation there was no stippling or induration found. Doctor Douglas said he separated the jejunostomy with the idea of reestablishing the old opening at the pylorus and had found proximally from the opening a small jejunal ulcer $\frac{1}{2}$ cm. in diameter in which there was a non-absorbable suture thread. A recent letter from this patient stated that he was free of symptoms.

DR. WILLIAM A. DOWNES said that one point Doctor Pool made was worth while emphasizing, namely, that it was better to explore the stomach or duodenum if there was any doubt as to the presence of an ulcer. He had followed this plan and never had had occasion to regret it. If one had made a mistake and no ulcer was found, he could content himself by taking out the appendix and save an unnecessary gastroenterostomy.

Doctor Downes stated that he had not used the clamps in doing a gastroenterostomy for several years. He had had two cases in which hemorrhage occurred while using clamps, in one of which he reopened the stomach and examined the stoma. The continuous suture had broken. This case recovered but the other proved fatal. Without the use of

RESULTS OF REMOVAL OF SEMILUNAR BONE

clamps one could draw the two portions of the stomach and jejunum together better than with the clamps, and certainly hemorrhage could be controlled better. In his experience Doctor Downes had never seen a case of infection result from not using the clamps.

DOCTOR ERDMANN said that in reference to Doctor Pool's remarks as to the exploratory gastrostomy operation for duodenal ulcer, he had done that a number of times with the same results that Doctor Pool had recounted.

In reply to Doctor Woolsey as to high proportion of marginal ulcers following the use of silk and Pagenstecher sutures, Doctor Erdmann said that though all surgeons were now using absorbable sutures, still one saw recurrent ulcers. While he did not wish to minimize the use of non-absorbable suture as a cause of recurrent ulcer, he felt sure that the cause was not yet recognized. He could not say whether marginal ulcer was due to the use of clamps or not, but he very firmly believed there was some other etiological factor which had not been found. Whether it was an idiosyncrasy or a chemical change or simply a habit, which was equivalent to an idiosyncrasy, he could not say.

Doctor Erdmann stated that he had had in all four marginal ulcers in cases in which he had found non-absorbable sutures. In the application of the suture method he had spoken of he simply took up the mucosa of the outer half of the opening in such a way that the two edges were directly apposed. He took up the submucosa and muscular with the peritoneal layers with a Cushing right-angle stitch, making the third row of Lembert sutures. Out of over three hundred gastroenterostomies he had had four or five hemorrhages. If one sewed the mucosa as a primary layer he prevented hemorrhage. He had been using this method for four or five years with very satisfactory results.

Stated Meeting held January 26, 1921

DR. JOHN A. HARTWELL in the Chair

FUNCTIONAL RESULTS FOLLOWING REMOVAL OF SEMILUNAR BONE

DR. ROYAL WHITMAN presented a man, aged twenty-six years, who had injured his right wrist while cranking an automobile. He had first come under Doctor Whitman's care in July, 1920, about one month after receiving the injury. Examination showed induration on the palmar surface of the wrist. Movements were restricted and painful, the grasp was weak, and there was a tingling sensation in the fingers, evidently due to pressure on the median nerve. At operation a displaced semilunar bone was removed. Now, six months later, function has been completely restored, although the patient thinks the hand slightly weaker than before.

DR. A. S. TAYLOR stated that he had had one case in which he had removed the semilunar bone. Full range of motion returned in six or

seven weeks, but the patient did not have full strength in the wrist for one year.

DOCTOR WHITMAN said that he had seen a number of cases of fracture and displacement of the various carpal bones. Usually operative treatment was refused, and the patient recovered with a somewhat stiffened but fairly useful wrist.

CARCINOMA OF THE TRANSVERSE COLON OPERATED UPON FOUR YEARS AGO

DR. GEORGE WOOLSEY presented a man who was admitted to Bellevue Hospital in February, 1917, at the age of sixty years. His history was that he had been a heavy drinker, but at that time he took only a few glasses of beer a day. He had complained of indigestion for two or three years, had suffered from gastritis a year ago, and since then had had epigastric distress and eructations much aggravated since October, 1916. Recently he had had colicky pains in the epigastrium and in the right side of the abdomen, eructation and occasional difficulty in retaining stools. The trouble was not relieved by taking food. He also complained of dyspnoea and palpitation. He had lost in weight, his weight being only 115 pounds; his average weight was 140 pounds. He had previously had a paralysis of the left side supposed to be due to a "stroke," and he still had some weakness of the left leg. The röntgenographic report was negative. A test meal of 200 c.c. was recovered containing remnants from the previous meal. The total acidity was 13. There was no free HCl; a trace of lactic acid; a trace of Oppler-Boas bacilli; no pepsin. These findings suggested gastric carcinoma. There was a feeling of resistance and an indefinite sense of a mass in the lower epigastrium.

The patient was operated upon on March 6, 1917; the stomach, duodenum and gall-bladder were found normal. The glands along the greater curvature and some in the transverse mesocolon were enlarged, and there was a mass involving the transverse colon with adhesions to the omentum and gastrocolic omentum. The glands were excised and the transverse colon resected in one mass, together with some retroperitoneal glands. The ends were closed and brought together, not in an isoperistaltic but in an antiperistaltic position, and a lateral anastomosis made. The anastomosing ends were then brought so closely together that there was no pouching. He used this method also between the ileum and the large intestine after removal of the carcinoma of the cæcum. The bowel was closed without drainage, and there was no leakage or infection. The mass inside the transverse colon was a scirrhus growth stenosing the lumen of the gut so that it would not admit the passage of a finger. There were scattered enlarged glands in the transverse mesocolon and behind the parietal peritoneum and a queer club-shaped Meckel's diverticulum with three or four projections from the end. The liver showed no metastatic growth. The specimen was pre-

TUBERCULOUS PERITONITIS

sented. The pathologist's report showed an annular, crater-like ulcer with overhanging edges and a firm, indurated base. The microscopic diagnosis was adenocarcinoma.

The convalescence was uneventful. So far as the patient was concerned there was nothing to see but the old scar. He had gained 35 or 40 pounds; he now weighed 140 pounds, his average weight, and was feeling perfectly well at the present time, nearly four years after the operation.

TUBERCULOUS PERITONITIS WITH CANCER OF OVARY (WELL AFTER FOUR YEARS)

DR. CLARENCE A. McWILLIAMS presented a girl, now nineteen years of age, who was admitted to the Presbyterian Hospital in March, 1917. While undressing a month prior, she noticed that her abdomen was swollen. She had never had pain in her abdomen except with her periods, which had always been profuse and painful. Had lost 18 pounds in weight. Never any cough, expectoration, nor indigestion.

On examination her lungs were normal. In the lower part of the abdomen, which was full, there was a suspicion of fluid which did not shift its position. Filling whole lower abdomen, extending to navel, there was a definite, immovable, non-tender, elastic mass. By rectum no masses were felt, but there was fullness in both fornices. A diagnosis was made of ovarian cyst. At the operation on March 24, 1917, there was considerable free abdominal fluid. There was an enormous hypertrophy of all the mesenteric glands, some being as large as lima beans; one was removed for examination. The small intestines were studded with irregular, rough, small masses which looked like papillary cystadenomatous implantations. The right ovary was the seat of a cyst the size of a grapefruit, and the left ovary contained a cyst the size of an apple. The tubes and the appendix seemed normal. The large right ovarian cyst was removed unruptured. The left smaller cyst was also removed unruptured, excising four-fifths of the organ. The appendix was also removed. The liver's surface was normal. The abdomen was flushed with salt solution.

Pathological examination showed the appendix to be normal, an unusual occurrence. The intestinal implantations and the lymph-glands were tuberculous. The left small cyst was found to be a simple cyst, while Drs. William C. Clark and A. P. Stout made a diagnosis of cancer in the large right cyst with many mitoses but little vascularity.

The patient has been seen from time to time in the Follow-up Clinic. In November, 1920, she was perfectly well. Had gained 75 pounds in weight. Was married in November, 1920. Periods have always been regular without pain and not profuse. Examination shows a firm scar with normal abdomen and with no fluid nor masses, nor enlarged glands. By vaginal examination there are no masses nor anything abnormal. The girl is now the picture of health, four years after a laparotomy in which advanced

tuberculous peritonitis was found and from whom a cancerous ovary was removed. The tuberculosis of the peritoneum was the most favorable type for a cure, that with free fluid and without adhesions.

DR. A. S. TAYLOR called attention to the fact that there was some difference of opinion as to the frequency with which tuberculosis and carcinoma were associated. At a recent autopsy Doctor Ewing said that carcinoma in a bronchus usually developed on a tubercular base.

DR. GEORGE H. SEMKEN said, with reference to the infrequent association of tuberculosis and cancer, his experience had not borne out the correctness of that belief. The cervical lymph-nodes removed in cases of cancer of the lip frequently showed tuberculosis as well as cancer; epithelioma often developed on lupus, and lupus was mentioned as tending to predispose, through chronic irritation, to the development of epithelioma. Tuberculin did not inhibit the growth of cancer tissue, and no good theoretical reason could be advanced why tuberculosis should have any influence on carcinoma except to favor its development.

DR. N. W. GREEN stated that Doctor Bastedo had reported cases of tuberculosis of the lungs accompanied by carcinoma in other organs before a meeting of the St. Luke's Hospital Alumni some years ago. He showed the association of cancer and tuberculosis to be sufficiently frequent to be noteworthy. His report, *Medical News*, December 17, 1904, is corroborated by ample literature.

DR. DE WITT STETTEN recalled that in 1909 he had reported two cases of carcinoma and tuberculosis coexisting in the same portion of the intestine. In one of these cases the lesions were at the ileocecal junction and in the other in the lower rectum. In both these cases the history and the pathological examination indicated that the carcinoma grew upon the tuberculosis and was, in fact, induced by the chronic irritation of the latter disease. It was, he thought, due to the teaching of the Rokitsansky school, that the idea that carcinoma and tuberculosis were mutually antagonistic had gained credence, but that to-day this view had been pretty generally disproved and discarded. Indeed, in certain instances, such as in his two cases, quite the reverse might be the case, and the local tuberculosis might lead eventually to the cancerous condition.

CARCINOMA OF PYLORUS, PARTIAL GASTRECTOMY UNDER LOCAL ANÆSTHESIA

DR. GEORGE H. SEMKEN presented a woman, aged forty-nine years, who came under his observation on June 6, 1920. Since early adolescence she had had occasional attacks of pyrosis following diet indiscretions, but there had been no definite "indigestion" until four years previously. The gastric disturbance since that time had been continuous. It began with epigastric pressure, borborygmi, and eructations of gas. Later, there was added the escape of a quantity of clear, tasteless, watery fluid from the mouth. These symptoms had been progressive and had become

PARTIAL GASTRECTOMY UNDER LOCAL ANÆSTHESIA

more severe. At no time had there been abdominal pain, nausea, or spontaneous vomiting. She had lived on liquid diet for the last year, had lost forty pounds in weight, and had become very weak.

Objectively the patient showed considerable emaciation and asthenia; there was a palpable, apparently movable mass above and to the right of the umbilicus; the stomach was enlarged and showed visible peristalsis but no splashing. The examination of the stomach contents showed free HCl 59, and total acidity 98 before the Ewald test breakfast, and free HCl 28, with total acidity 59 after the meal. Both showed much mucus and little blood. Oppler-Boas bacilli and lactic acid were not reported. The X-ray examination showed an annular growth in the lower third of the stomach that presented all the characteristics of malignancy. There was marked retention, about three-quarters of the meal remaining in the stomach after twenty-four hours. The Wassermann was negative.

At the time of operation on June 10, 1920, owing to the markedly asthenic condition of the patient, it was planned to begin with local anæsthesia (novocain) and to continue with it as long as that was feasible. In addition to the infiltration of the abdominal wall it was necessary to infiltrate the region about the pancreas. No further anæsthesia was necessary and the patient bore the operation very well, though with some discomfort.

A fibrosed carcinomatous ulcer was found at the pylorus which had produced almost complete occlusion and a secondary, considerable enlargement of the stomach. The tumor was adherent posteriorly to the pancreas; there were some enlarged nodes in the gastric colonic omentum and also along the lesser curvature, but none were found at the uppermost level. Adhesions between the upper surface of the liver and the diaphragm evidenced a previous inflammation. No other pathological changes were found.

The partial gastrectomy, taking about two-thirds of the stomach, was done, following the Billroth No. 2 technic. Aside from a transitory albuminuria with casts that continued for a few days, the patient made an uneventful recovery and was able to leave the hospital seventeen days after the operation. Her progress has been excellent since that time; she regained her normal weight and has no gastric disturbances.

DR. GEORGE WOOLSEY said he had not had occasion to resect a stomach under local anæsthesia, but he had done a gastroenterostomy under local anæsthesia. Provided the patient was not too stout it was easy for the patient and the surgeon. If the patient was stout it was almost unavoidable that one should make some traction on the posterior parietal peritoneum that would be painful. Abdominal operations could be readily done under local anæsthesia provided the patient was not too stout.

DR. ALLEN O. WHIPPLE said there was one indication where local anæsthesia worked unusually well. He had had two cases of cardiac disease in which general anæsthesia was out of the question. One of these

was thought to be a carcinoma of the pylorus which proved at operation to be an ulcer, and a gastroenterostomy was done under local anæsthesia without any real distress to the patient. The patient, who was a very intelligent man, was very much surprised that he experienced so little pain. The other case was one with disease of the common duct and a cholecystectomy and choledochostomy was performed under local anæsthesia. Both of these patients were fibrillators, and neither of them had fibrillation following operation. That was unusual, and if they had been given general anæsthesia they would very likely have had fibrillation.

DR. N. W. GREEN thought there was a class of patients that could be saved if operated upon under local anæsthesia which would die with increased blood urea nitrogen or acidosis under general anæsthesia. When the blood urea nitrogen was as high as 35, 40 or 50, general anæsthesia might be considered unsafe, but operations could safely be done under local anæsthesia. The strain on the surgeon was much greater when local anæsthesia was employed because he had to work more slowly and more carefully, and he could not operate upon as many patients in the same time as with general anæsthesia; but he felt that one could save some patients by the use of local anæsthesia that could not be saved if general anæsthesia were used.

DR. A. V. MOSCHCOWITZ said that up to within a very short while he had been doing both lobectomies and subtotal thyroidectomy with local anæsthesia. He was under the impression that he was particularly courageous to do so, because the operation took a long time and had to be done very slowly. Since a recent visit to Doctor Crile's clinic, Doctor Moschcowitz had changed his technic in so far that he had discarded a purely local anæsthesia, and had performed all subtotal thyroidectomies in general anæsthesia, *i.e.*, under laughing gas, aided by a small quantity of ether. He had learned to perform the operation in one-third of the time it formerly took him. He had also found that patients stood this anæsthesia and operation perfectly well; in fact, he had operated cases of pronounced cardiac arrhythmia, and had found that subsequent to the operation this arrhythmia disappeared.

DR. JOHN R. HARTWELL said he felt that in the use of local anæsthesia the suffering was not only on the part of the patient but on that of the surgeon. If the patient was given a preliminary dose of morphine, and the room was quiet and the patient encouraged not to be panicky, almost any operation, a partial gastrectomy, gastroenterostomy, cholecystectomy, etc., could be done under local anæsthesia. It was being used more and more. It was a question of being willing to take the additional time and care and the additional mental effort and strain, but he believed it had a great advantage in that it required the surgeon to do very careful and neat work; the patient would not allow him to do otherwise. From the educational standpoint, the increased use of local anæsthesia had a very beneficial effect all along the line. It was surprising

LATE SUTURE OF THE MUSCULOSPIRAL NERVE

how much could be done under local anæsthesia. Of course, with the use of paravertebral and spinal anæsthesia the field of local anæsthesia was still further extended.

DR. SEMKEN stated that the success of local anæsthesia in abdominal operations depended largely upon a proper teamwork between the operator and the patient. A preliminary hypodermic injection of morphine was considered essential. A preliminary explanatory talk with the patient was just as essential; he should be informed as to just what he would feel and how severe it would be. The handling of viscera must necessarily be gentle and no sudden movement of retractors or sudden traction upon the viscera should be made.

The patient whose case was presented had a high degree of acidosis through inanition. The transitional nephritis that followed the operation was highly suggestive. It was interesting to consider what effect an ether narcosis might have had in this case.

With reference to Doctor Moschcowitz's remarks concerning his preference for ether narcosis in thyroidectomies, Doctor Semken suggested that Doctor Moschcowitz would probably have even better results if he would use ether colonic anæsthesia in those cases.

LATE SUTURE OF THE MUSCULOSPIRAL NERVE

DR. JOHN A. HARTWELL presented a man, aged twenty-eight years, who, on May 4, 1920, received a stab wound in the left arm above the elbow-joint. The knife passed from the outer side of the arm, above the external condylar ridge, downward, forward and inward and emerged on the inner aspect of the arm just above the inner epicondyle. Examination failed to show that the sensory distribution of the musculospiral nerve was involved. There was noted disability in the distribution of the extensor muscles to the wrist and hand which was referred to the fact that the muscles themselves were extensively cut by the stab wound. The wound was cared for in the usual manner and healed promptly, patient having left the hospital at his own request, eight days after the injury. He returned to the follow-up clinic on June 14th, when the following note was made: "The extensor muscles of the forearm show atrophy. There is a complete loss of power to extend the wrist or to adduct it. There is also loss of power in the extensor muscles of the fingers. Pronation and supination are normal. There is a partial loss of pain and tactile sense over the posterior portion of the thumb and the web between it and the index finger. The condition is evidently a complete severance of the musculospiral nerve."

Operation was performed June 18th, forty-five days after injury, at which time there was found a complete severance of the nerve one inch above its division into the two main branches. Each end presented the usual end-bulb about one-half inch in length. The nerve was exposed in its passage around the humerus and followed downward to its bulb-

ous end. An incision was then carried downward and curved a little forward into the substance of the extensor group of muscles, where the distal bulb was found buried in a dense scar tissue. The nerve was thoroughly freed in both directions. All scar tissue was dissected away so as to make a clean muscular bed for the nerve. The bulbous ends were cut off and the sections carried back carefully into the normal nerve fasciculi were plainly distinguishable and the "blood sweating" appeared. These conditions demonstrate that normal nerve tissue has been reached. The interval between the two ends was not more than two inches, and by flexing the forearm to 100 degrees the nerve-ends were brought into apposition without resorting to stretching and were very carefully sutured with the finest silk stitches, penetrating only the perineural sheath so that at the termination of the suture all the fasciculi were well within this sheath. Care had been taken throughout to maintain the proximal and distal segments in the natural relation of the nerve-fibres, so that so far as possible proximal fasciculi were in contact with the proper distal fasciculi. The nerve-bed was reestablished by resuturing the muscles with plain catgut. It was noted that the forearm could be moved through an arc of from 100 degrees to 90 degrees flexion without putting any tension on the nerve. The arm was, therefore, put up in a moulded splint about 95 degrees flexion at the elbow and complete dorsal flexion at the wrist. Healing of the wound took place by primary union. At the end of two weeks the splint was removed daily and the arm carried through a passive motion of 15 degrees. This procedure was continued until the end of five weeks after operation. It has been shown experimentally by Dean Lewis' staff that at this time nerve union is firm. The splint was, therefore, removed and the patient was given a cock-up splint for the wrist and told to passively and actively move the elbow. During the following weeks he had massage, and on the ninetieth day, post-operative, he stated that he could feel power returning to the paralyzed muscles. Thereafter all splints were removed, and he was instructed to actively engage in reeducation of the muscles. His improvement since then has been rapid, and at the present time it is difficult to recognize that the arm has ever been cut.

There are two points of interest in this case. First, that the examination of a suspected injury of the musculospiral nerve must be carried out with extreme care because of the fact that its sensory distribution is so overlapped in many cases by the median and ulnar nerves that the anæsthetic area is exceedingly small. In this case it was overlooked, the note being made that there was no apparent disturbance in sensation. Further, if the injury involves the muscles, it is difficult to differentiate the resulting disability from that due to muscle injury itself, as in this case.

The second point of interest lies in the fact that one can so accurately determine the probable time of return of power. It is estimated that the distance from the severed nerve to the upper muscular distribution is

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between 90 and 100 mm. and it is exactly at this period that the power began to return. From that time the power steadily improved as the more distant portions of the muscle were reached by the ongrowing nerve fasciculi. This fact proves the proximal and distal segments were laid in their normal relation, because it has been demonstrated that the regeneration and reëducation of the nerves and muscles is delayed if upper fasciculi and lower fasciculi are not in proper contact.

LATE SUTURE OF ULNAR NERVE

DOCTOR HARTWELL also presented a woman, aged twenty-five years, who was struck by an automobile on September 2, 1920. She had multiple injuries about the face and body, all of which were exceedingly lacerated and very dirty. One wound was in the left forearm, along the inner surface at about its middle, where there was about three inches of lacerated muscle exposed, and a posterior wound opposite this on the outer side on the back of the forearm. The wounds were all treated by *débridement* and sutured. There was no note made as to sensation of the hand in this case, and again the muscular disability was assumed to be due to the loss of muscle substance. The ulnar nerve was not seen in the operation, and it was only discovered at the end of a week that it had been severed. There was a certain amount of suppuration in the forearm, so the repair of the nerve was delayed until November 5, 1920, sixty-three days after the injury, for fear of a secondary infection taking place. At the operation the nerve was found divided about four to five inches above the annular ligament, where the two ends were found lying in very dense scar tissue representing the repair of the damaged flexor carpi ulnaris muscle. The same procedure was followed as in the preceding case, and because of the extensive scar tissue and bulb formation a defect of three inches existed. In order to overcome this it was necessary to free the ulnar nerve from its bed to well above the epicondyle. By continued gentle traction on the nerve at an estimated pull of about five pounds it was in ten minutes sufficiently stretched to gain the necessary three inches. Suture was then carried out in the same manner as described and the soft parts were similarly repaired. It was found that the nerve could be replaced behind the internal condyle without tension on the suture line, and this was accordingly done. It is estimated that the distance from the suture to the muscles of the hand was seventy-five mm., so that we should now find returning power in these muscles if our suture was accurately applied.

A second factor, however, may be present in this case, in that the nerve was so extensively stretched. It is possible that regeneration may be delayed by this procedure, though we have seen no comment in the literature on this point. A further report showing the final outcome in this case will be made.

DR. ROBERT T. MORRIS asked, in reference to the musculospiral nerve

regaining its function, whether it might not be true that delayed sensation in the thumb was due to the radial nerve being left out of the suture line. The radial nerve sometimes left the musculospiral higher up than the site of the stab wound in this case. Would a fat graft have helped avoid interposition of connective-tissue cells between cut ends of the radial fasciculus?

DR. A. S. TAYLOR said, in regard to the ulnar nerve, it seemed to him a question whether traction involving elongation 30 to 50 per cent. of the involved nerve was desirable. He thought it had been demonstrated that pulling on the nerve would stretch the nerve-sheaths and tubules, but was apt to crack the axis cylinders, and this would certainly delay recovery. Transposition of the ulnar nerve to the anterior aspect of the elbow would give increased length and had been done with most prompt and satisfactory results.

As to the fat graft suggested in the discussion, Major Huber had found that it degenerated into cicatricial tissue which constricted the enclosed nerve and that regeneration of the nerve was better if normal muscle was used as a new bed for the nerve.

DOCTOR HARTWELL said that his first effort was to suture the nerve without stretching, but after it was dissected free as far as was practicable it was still three inches short, and placing it in front of the condyle did not seem to be of much advantage.

NON-TUBERCULOUS INFLAMMATION OF CÆCUM

DR. JOHN A. HARTWELL presented a boy, aged fourteen years, who was admitted to the hospital November 27, 1920, with evidence of a chronic lesion in the right iliac fossa, an acute exacerbation of which was present. He was an Italian and at the time was pale and undernourished, pointing to the possibility of a tubercular infection. Under anæsthesia a distinct tumor could be felt in connection with the cæcum. The specimen showed a very extensive inflammatory process involving the appendix, the cæcum, and a small portion of the ileum. The cecal wall is thickened to more than one-half inch, and at the time of operation it was impossible to determine whether the condition was tubercular or not. The regional lymph-node was involved, but there was an absence of any miliary tuberculosis. The wiser procedure seemed to indicate a resection of the bowel, with the probability that tuberculosis was present. This was done in the usual manner and the lateral anastomosis made between the ileum and the first part of the transverse colon, with the closed ends both pointing toward the right. The closure all seemed satisfactory and no drainage was used, though the omentum was so placed that in place of leakage the discharge would find its way to the abdominal incision. This occurred and a small fecal fistula was present, but is practically healed at the present time.

The interest in this case is the fact that a very careful examination of

the appendix and cæcum fails to show any positive evidence of tuberculosis, though Doctor Hartwell said he was not willing to say that this was excluded, as referring to the paper read by Dr. Seward Erdman last year demonstrated the difficulty of always finding tubercular tissue in these lesions even though it is present. The second point of interest was the type of anastomosis that should be made in these cases; that was, whether leakage was less apt to occur in either an end-to-end or end-to-side anastomosis, or a side-to-side anastomosis as here used, and also whether any especial attention should be paid to the relation of the anastomosis to the longitudinal band on the large intestine.

DR. SEWARD ERDMAN said as to the case of non-tuberculous inflammation of the cæcum, that he had reported a similar case last year, and he felt that the follow-up would solve the question and the case might prove to be one of tuberculosis. He had been looking up the literature of the subject and had been impressed by the fact that a number of cases in which no tuberculosis was demonstrated in the pathological specimen at first, nevertheless later examination and the course of the case proved tuberculosis. Apparently the consensus of opinion was in favor of the side-to-side anastomosis of small intestine to colon, although some surgeons used the end-to-end anastomosis. Of course, the side-to-side anastomosis had certain advantages; it took a little longer, but there was never a question of blood-supply as there was always a perfectly good blood-supply around the stoma; there was also plenty of serous apposition surrounding the anastomosis, and both of these were lacking in the end-to-end or end-to-side anastomosis.

DR. GEORGE WOOLSEY said, with reference to anastomosis of the two ends of the large intestine, if one end was much larger than the other they were not well suited to end-to-end anastomosis. In the case he had presented the proximal end was not enormously distended, so there was not a great difference between the two ends. One could make as large a stoma as he wished with a side-to-side anastomosis. There was one advantage in bringing the two ends together, fastening them side by side and making an antiperistaltic anastomosis, and that was that it left less pouching, whereas if one had an isoperistaltic anastomosis there was more tendency to pouching of the blind ends.

This patient he had presented and he did not drain the wound at all but sewed it up tight. Except where he had not put in a drain he had been compelled to drain afterward. So far as the longitudinal band was concerned, he had not avoided it in making an anastomosis, and he thought he would rather choose a band because it made a smoother surface.

DR. SEMKEN stated, with reference to Doctor Hartwell's question concerning the best form of anastomosis to be used in resections of the colon, that the last publications from the European clinics, as well as those in the United States, seem to favor a return to the end-to-end method. The unfortunate results obtained in many of these cases in former times were

ascribable to necrosis of the margin of the gut segments. Lockhart-Mummery had called attention to the vascular supply of the colon in explanation of this occurrence. The vessels were radial and ended in a radial ring about the circumference of the gut. The mesenteric stitch often caught this terminal vessel and cut off the supply of blood from the edge of the intestine. To obviate this, Lockhart-Mummery advised an oblique cutting of the gut instead of the usual transverse division. This suggestion was advanced many years ago as a method of increasing the lumen of the gut at the site of the anastomosis and minimizing the danger of post-operative contracture. Horsley and Soresi called attention to the danger of infection of the small triangular space at the mesenteric junction, and advised the closure of this space before the intestine is opened.

The Mayos had made the excellent suggestion of slightly rotating one segment of the gut about its long axis to bring the mesenteric junction points at different places, so that there would always be at least one serous surface in the anastomosis at all points. As to the relative values of iso- and antiperistalsis in the placing of the intestinal segments in lateral anastomosis, it had been shown by Schmieden that the gut evidently soon transforms all of these into a relatively straight canal; but it was important that no blind pouch be left.

In cases of resection or cancer of the colon the most important point in the technic was the removal of the related lymph-nodes.

ULCER OF STOMACH—HODGKIN'S DISEASE

DR. JOHN A. HARTWELL presented a man, aged forty-five years, who was admitted to the hospital February 7, 1920, giving an indefinite history of gastric disturbance extending over a period of years and which has become very marked during the last nine months. During this latter period he had had some gastric pain coming on from one-half to two hours after eating and on several occasions has vomited large quantities of blood. He had also passed blood by stool. At the time of his admission he was much under weight and showed loss of blood. The X-ray examination showed a disturbance of function around the pylorus which at operation was found to be due to perigastric adhesions in which the gall-bladder seemed to be the exciting cause. X-ray failed to show an ulcer which at operation was found on the anterior surface of the stomach, at the junction of the cardiac and middle thirds. This ulcer was about one and one-half inches in diameter, had a hard, distinct border, but showed no tendency to perforate the stomach wall. The operative procedure consisted in a cholecystectomy and release of the pylorus from the rather extensive but recent adhesions which were found and an excision of the ulcer with local repair. The lumen of the stomach seemed to be well established after this procedure, and consequently no gastro-enterostomy was performed, though it was thought that either this or a

gastrogastrotomy might be later required. This had proved not to be the case, as the patient is now in good condition. The X-ray showed the stomach functioning well, and he had gained some thirty pounds in weight. He still, however, suffered from some mild gastric symptoms which were easily controlled by regulation of diet.

The pathological report on the ulcer, Doctor Hartwell said, was the matter of interest in this case, the gross specimen consisting of a gastric ulcer with a narrow rim of stomach surrounding it. The actual ulcer was about one inch in diameter. Its margins were irregular and scalloped and in some parts undermined. The base was formed by a firm, fibrous-like tissue about 1 cm. in thickness. Peritoneal covering on this point was reported as having been removed, but was not involved. Sections of the ulcer showed extensive thickening of the mucosa and submucosa in the involved area by round-celled infiltration. The round-cells were closely packed together and septa of fibrous tissue divided the infiltrated area into coarse lobules. The glandular tubules of the mucosa were almost completely destroyed. The muscular coat was involved in a very slight degree. Some of the vessels, however, showed marked sclerosis with perivascular round-celled infiltration. The mucosa at the margin of the ulcer showed cystic dilation of some of the glandular tubules but was otherwise about normal. *Diagnosis:* Chronic gastric ulcer, possible tuberculosis or syphilis.

Sections were made and stained with carbol-fuchsin and by the Levaditi method, but no tubercle bacilli nor spirochaetes could be found. A section of the tissue was submitted to Dr. Charles Norris for examination without knowledge of its origin. He pronounced the histology that of Hodgkin's disease, but was unwilling to say positively that it should be so classified. Dr. James Ewing was of a similar opinion, giving the diagnosis of infectious granuloma, but was unwilling to rule out malignancy by the sections he saw, as there are certain areas in which epithelial-like cells were found penetrating into the substance of the granuloma. The section was presented for inspection.

So far as discovered the literature showed only a few cases of Hodgkin's disease of the stomach, though it was found in the intestinal lymphoid tissue. An examination of the chest of the patient failed to show mediastinal lymph-nodes and up to the present time there was no evidence that he had other foci of Hodgkin's disease.

The question was well summed up in "Ewing's Neoplastic Diseases, 1919," as follows:

"Gastro-intestinal Hodgkin's granuloma is an ill-defined condition difficult to separate from tuberculosis, on the one hand, and lymphosarcoma, on the other. The group of diffuse lymphomas affecting a large portion of or the entire gastro-intestinal mucosa (Stoerk, Wells, Symmers) must, I believe, be given a separate position, since they differ widely in structure and distribution from typical Hodgkin's granuloma.

There remains a considerable group of locally destructive hyperplastic lesions located in any portion of the gastro-intestinal tract, especially in stomach, ileum, and cæcum, in which the structure is distinctly granulomatous and in which tubercle bacilli are missing. I have studied several cases of this type, with local ulceration and extensive swelling of regional nodes, in which the lesions resembled Hodgkin's granuloma. Coupland and LaRoy have described typical cases, but reports in the literature are scanty, since most of the cases are interpreted as lymphosarcoma."

DR. JOHN DOUGLAS said that in looking up the literature of sarcoma of the stomach when he read a paper on this subject before the society a year ago, he had found that the majority of intrinsic disseminating sarcomas of the stomach which were reported were of the lymphosarcoma type.

So far as the pathology of Hodgkin's disease and lymphosarcoma were concerned, though he was not a pathological expert, he thought that the microscopical appearances of the two conditions were so similar, the fact that at the end of a year this patient showed no signs of Hodgkin's disease elsewhere, indicated that he should be classed with the lymphosarcomas. He believed that in all probability the reported cases of lymphosarcoma and Hodgkin's disease of the stomach were of the same nature.

DOCTOR HARTWELL said that Doctor Ewing's statement was that many cases that appeared in the literature among lymphosarcoma belonged to Hodgkin's type of disease if there was any difference between the two.

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